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NATIVE HUNTER AND TAKIN

Not more than six or seven white men had killed the Shensi form of takin before the author entered the mountains where it is found and obtained two specimens of this spectacular animal, which is related to the chamois, goral, serow, and the so-called Rocky Mountain goat. Later, native hunters whom he left in the region obtained three additional specimens. It is the intention to use these five animals in a group that will be one of the arresting features of the proposed Asiatic hall of the American Museum

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HUNTING TAKIN IN THE MOUNTAINS OF SHENSI

BY

ROY CHAPMAN ANDREWS*

SHORTLY after Mr. Pope left for the south I completed my own preparations for a visit to the Tsinling mountain range, southwest of Sianfu in Shensi Province. The object of this expedition was to obtain specimens of the rare takin (*Budorcas bedfordi*). This species, which was discovered by Mr. Malcolm Anderson, while on the Duke of Bedford's expedition, under the direction of the British Museum of Natural History, is one of the rarest and most interesting animals in China. The takin belongs to a group known as the *Rupicaprinae*, which comprises the chamois, goral, serow, takin, and the so-called Rocky Mountain goat of America. They are often spoken of as the "goat-antelopes" because they hold an intermediate position between the true goats and the antelopes.

This group is an excellent example of one the members of which have migrated both to Europe and America from a central Asian point of origin. Although takin of different species are found in Assam and western Szechuan along the borders of Tibet, the Shensi form is very much less known and has been killed by not more than six or seven white men. We were particularly anxious to get a complete series for a group to be placed in the hall of Asiatic life that will be located in the proposed south-east court building of the American Museum, but it was important also to

make a reconnaissance of the Tsinling mountain range.

This vast chain of mountains, which extends east and west through the center of China, appears to have been a faunal divide even in early geological times, as it is today. It has never been carefully investigated and is one of the most attractive fields for the accomplishment of a splendid piece of zoölogical work, both from the standpoint of species new to science and from that of distribution.

I invited Captain W. F. Collins, of Peking, to accompany me on this trip and was particularly fortunate in my choice of a companion. Not only does Captain Collins speak Chinese fluently, but he has a very thorough knowledge of Chinese characteristics, which knowledge in a province such as Shensi, where there is a good deal of anti-foreign feeling, proved to be of invaluable assistance.

Our mule trip of seven days from the end of the railroad to Sianfu, the ancient capital of China, was without incident. Although we had no difficulty in getting into Sianfu, it was somewhat of a problem to get out, because the new Tuchun, or military governor, was carrying on operations against the troops of a certain General Chang Fei-sheng. A full-sized battle was raging not more than five miles to the west of the city and directly on the road which we wished to take. Captain Collins and I were warned that

*Leader of the Third Asiatic Expedition which the American Museum is conducting in coöperation with the American Asiatic Society and Asia.



A varied bag, consisting of pheasants, hares, snipe, and geese

we were probably putting ourselves in a very dangerous position by leaving the city, but we felt confident of our ability to get to the Tsinling Mountains without serious difficulty.

By making a wide detour as soon as we left the city gates, we avoided the fighting area and after crossing the Wei River arrived at the base of the mountains four days later without having had the slightest trouble. Our destination was the Tai-pai-shan (Great White Mountain), a series of peaks almost in the center of the Tsinling range and the exact locality from which the first specimen of the Shensi takin had been obtained by the late Malcolm Anderson. Our way led up a rocky river bed along the cliffs at the side, and late on the night of the fifth day we stumbled through the darkness into the little mountain village of Lingtaimiao. We camped in a temple which has been occupied by every one of the foreigners who have killed the Shensi takin. Other sportsmen have had the advantage of a famous old hunter named Yong, but we learned that he had died two years pre-

viously and we had to depend on his son, a youngster of eighteen, who was afflicted with laziness to a remarkable degree, even for a Chinaman.

For two days it rained steadily and the summits of the peaks were enveloped in a thick gray blanket, but my traps, which had been set in the fields near the temple, yielded a surprisingly interesting collection of mammals. On the third day we left with eight carriers to make camp far up the mountain at an altitude of 11,000 feet. Nowhere in China had either of us seen such great numbers of pheasants as we found in the river bottom. We shot one woodcock, four hares, and nineteen pheasants without going more than a hundred yards from the trail. Four miles from the temple we entered a deep, densely forested gorge, which led rapidly upward toward one of the highest peaks. At night we camped beside an overhanging ledge of rock under a beautiful, starlit sky. We had come up through an interesting series of floral zones. On the lower parts of the mountain there is a mixed forest of oak, pine, larch, and birch, then a clear-

cut area of dwarf bamboos, and finally the rhododendron zone. In New York we know rhododendrons only as beautiful shrubs, but here we found them as trees reaching a height of twenty or even thirty feet, their tops spreading out and interlacing to form a canopy of twisted branches and dark green leaves.

When we passed upward out of the high rhododendron forest, we reached the dwarf trees, which were only six or eight feet high, but so closely intergrown that it was well-nigh impossible to force our way through them even when we followed old woodcutters' trails. Above the rhododendrons stretched the peaks, here and there giving sustenance to a stunted larch. Our camp was in a beautiful meadow beside an underground stream, which came to the surface in a little well just at the door of the tent. Below and to the east was a wonderful panorama of forest-clad peaks; to the west a great rock-slide which had thundered down from a granite pinnacle, possibly hundreds of years ago. To the north a rounded ridge lay thick with snow. It was a wild place, fit habitat for one of the strangest animals of the world.

We were among the clouds, and masses of vapor were continually weaving in and out between the peaks and suddenly enveloping us in a damp gray blanket. We could never predict more than half an hour in advance what the weather would be. The sun usually rose in a sky of brilliant blue, but at any moment clouds might roll in from below or above and a drizzling rain begin. During the fourteen days we were hunting takin we were not dry more than a few hours at a time. For two days we hunted unsuccessfully on the peaks surrounding camp, finding only a few very old signs of takin. On the morning of the third day, before we started out, one of the carriers built himself a little shrine not far from the tent, produced several sticks of incense from somewhere among his voluminous coats, and proceeded to sacrifice at his little altar, placing several tiny cups of

rice and food beside the incense sticks. He assured us that we would find takin that day and, sure enough, we did.

About noon, after an exhausting scramble through the rhododendrons to reach the peaks almost opposite camp, we saw six yellow specks moving about in the dwarf bamboo on the steep side of a mountain not more than seven hundred or eight hundred yards away. Through our field glasses we could see the takin plainly and never have I had such a thrill upon beholding an animal for the first time. The brutes, almost as large as small cows, were climbing about among the bamboos on the seemingly perpendicular wall. Their golden yellow hair contrasted strangely with the green of the bushes, and in looking at them we could think of nothing but the reincarnation of the Golden Fleece.

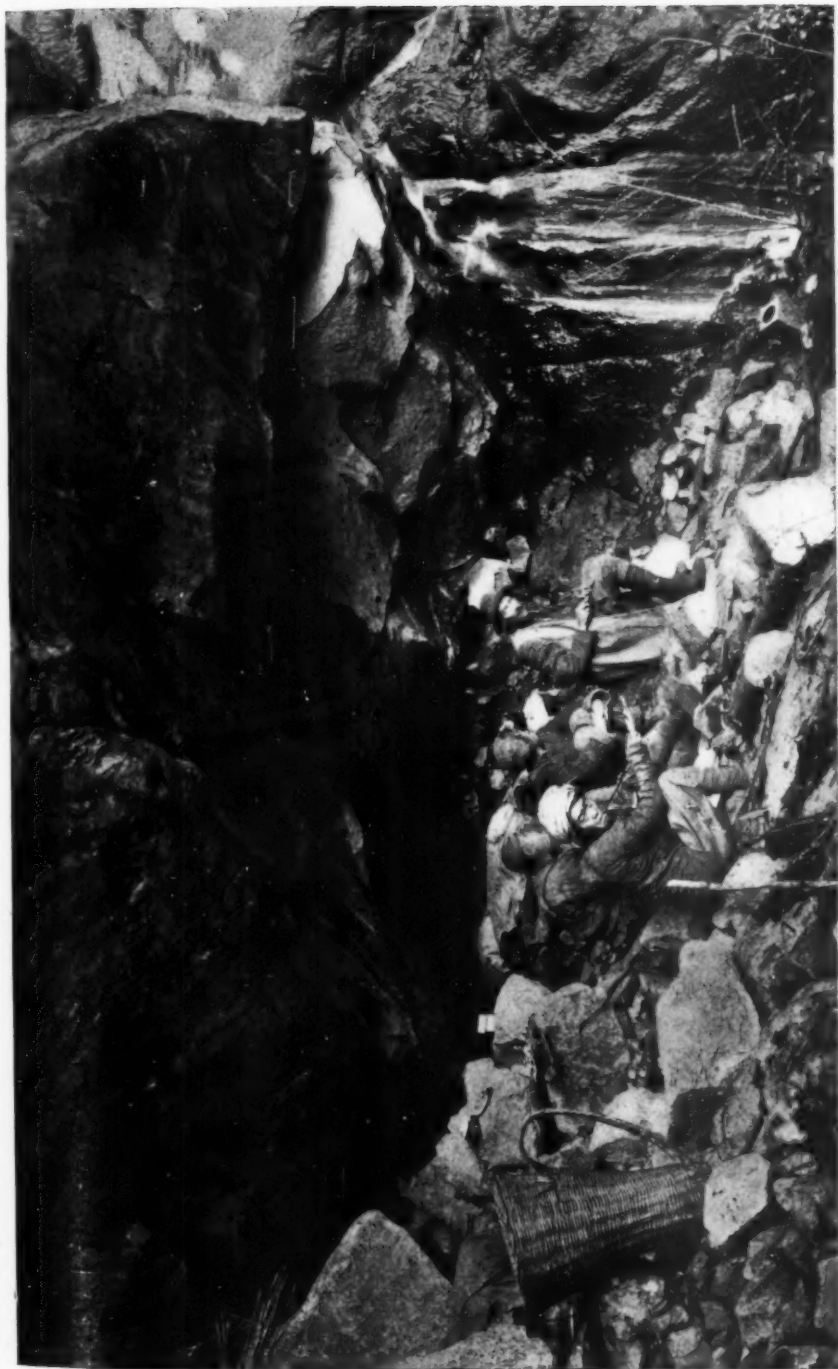
Although the animals were almost within long rifle shot, they were on the opposite side of a cañon with walls dropping sheer for more than a thousand feet, and the only possibility of a successful stalk was to go around to them. This took six hours of the hardest work I have ever done and it was a short time before dark ere we arrived, absolutely exhausted, at the base of the cliff where we had seen them.

We fought our way to the summit only to find that the animals had gone over the other side and were out of reach, for night was closing in. There was nothing for us to do but return to the bottom of the gorge where we hoped that the two men whom we had sent back to camp for food and our sleeping bags would possibly find us. It was raining steadily, we were soaked to the skin, our hands were scratched and torn, and we were faint from lack of food, for we had had nothing to eat since morning. It was rather a cheerless prospect as we stood about a tiny camp fire, trying to dry bits of our sodden garments and keep our teeth from chattering. Our chief worry was that we had no food for the next day and we knew that it would be



TYPICAL TAKIN COUNTRY

It was over these mountains that the animals were hunted. The two secured by the author were shot on the ridge seen in the background



A CAMP IN THE MOUNTAINS

Under overhanging rocks like the one in the picture the party in search of takin would camp at night. Captain W. F. Collins and three natives are seen relaxing after the hardships of the hunt



A SPLENDID RAM
This animal was secured by the author in Shansi, one of the provinces bordering Mongolia on the south

well-nigh impossible to face the hard climbing which was between us and the takin if we did not have something to eat.

About ten o'clock, as we were trying to build a shelter of bamboo branches, the two men whom we had sent back to camp appeared with our sleeping bags and a little food. They had seen the light of our fire when nearly three miles distant and had made their way to it in almost total darkness over cliffs which I should not care to travel again even in daylight. To make a long story short, we found the takin at noon the next day and I was fortunate enough to get two, a splendid female with her half-grown calf. Although I had wanted to kill a takin for many years and had dreamed about it almost every night for weeks, I was so exhausted physically that when the actual moment for shooting came I had not the slightest thrill of pleasure, only a feeling of great relief that the hunt was ended.

We photographed and skinned the takin and started back for camp. Laden down as we were, we could not go back the way we had come, and it was two days before we reached our destination, which in a straight line was less than a mile distant.

A day of hunting in the vicinity of camp was no more successful than our earlier attempt had been to come upon takin in that area. Accordingly Collins and I set out with three bearers carrying our sleeping bags and rice enough to last for a week, with the intention of striking into the mountains near the place where we had shot the takin cow.

We were gone six days, and although we followed takin tracks for two or three days at a time, we did not see another takin. At night we slept under overhanging rocks wherever we happened to be, crawling into our sleeping bags almost too exhausted to cook our rice. Our hands and legs were in a terrible condition from deep scratches and superficial infection, and our bodies were bruised

from innumerable falls, but still there was always the hope of finding takin the next day. At last we were forced out of the mountains by a heavy snow storm, which made hunting absolutely out of the question.

I did not have sufficient specimens, but had collected rocks, vegetation, and all material necessary to reproduce the group in the American Museum. We decided to leave two of our native hunters on the spot with instructions to wait until after the snow had melted and not to return without two or three takin. We thereupon descended to the little temple at the foot of the mountain to obtain mules for the journey back to Sianfu and to supply our native hunters with the proper collecting outfit. While we were sojourning at the temple, the village was thrown into a turmoil one evening by the appearance of two hundred brigands. These were the former soldiers of General Chang Fei-sheng, who would be shot if they returned to their own homes and who had consequently taken to the hills. They were a rough-looking crowd, each man carrying two bandoleers of cartridges, one or two Mauser pistols, a bayonet scabbard, and a rifle or two.

A short time after their arrival we received a visit from the chief; he had a cut in his hand and when I offered to dress it for him, he was very grateful and asked if I would attend to the wounds of several of his men. The result was that I spent all of the next day and a part of the day following that in patching up bodies, heads, legs, and arms. When we were ready to leave, the brigand chief offered us an escort until we were out of the territory which his men were holding.

Although these bandits treated us so courteously, I subsequently learned from my native hunters that, after the brigands had exhausted all the food in the little village, they took several of the most well-to-do farmers and tortured them by slowly roasting them over hot

coals until they had revealed where food and money had been hidden. The two hunters that we had left behind became so frightened at these proceedings that they fled back into the mountains for two days and in this way happened upon a fine shooting locality where they found abundance of game. Not only did they kill three splendid takin, but obtained a bear, wild pig, deer, and serow, as well as a magnificent collection of small mammals, many of which are undoubtedly new to science.

Because of the disturbed state of affairs in Shensi, I was greatly worried about the safety of these men, but I am glad to say that they reached Peking, all their collections intact, without having had any trouble.

After a stay of a few days in Peking I left again for a trip along the south Mongolian frontier. My companion was Lieutenant-Colonel H. St. Clair Smallwood, and we visited a region contiguous to the one from which Mr. Caldwell and I had secured a series of mountain sheep some years previously. The railroad

has been extended to within six miles of the place where Mr. Caldwell and I hunted and has sounded the death knell of the splendid sheep and wapiti which still exist in the isolated range of mountains that occupies that area. I venture to predict that within three or four years at the most these animals will become almost totally exterminated.

Our hunt was very successful. We obtained a series of small mammals which are of considerable importance, as well as eight sheep, two wapiti, a wolf, and a roebuck. I became ill after three weeks and had to return to Peking, while Colonel Smallwood visited the wapiti locality alone, and the credit for having obtained the specimens of this important animal is due entirely to him.

After a week in bed I equipped three of my native collectors and dispatched them to various promising localities to carry on the winter zoölogical work. We have now collectors in five different provinces of China, and there is a steady flow of material arriving at the headquarters in Peking.



Typical sheep ground in northern Shansi



Courtesy of Monsieur V. Forbin

The only creature now alive that looked upon Napoleon

HISTORIC TORTOISES AND OTHER AGED ANIMALS

BY

FREDERIC A. LUCAS*

OUR good friend M. Forbin, to whom we are indebted for many interesting items and illustrations, recently sent us a photograph of the only creature now alive that saw the great Napoleon. This is a tortoise from Aldabra that is still living a peaceful existence at St. Helena though Napoleon passed away a century ago (May 5, 1821). How old this tortoise was when brought to St. Helena, we know not, but venerable as it seems to us with our

allotted span of threescore years and ten, its age is exceeded by that of another tortoise that is—or was recently—living in the Island of Mauritius whither it was brought from the Seychelles many years before, being even then of unusual size. In Mauritius it became a national possession and in 1810 was specifically mentioned in the treaty by which the French ceded Mauritius to England. "It is said" to have lived in Mauritius for at least seventy years previously, so that

*Director of the American Museum

it is pretty safe to conclude that it is at least 150 years old.

Unfortunately this tortoise has been confounded with another brought to England from Mauritius in 1897, through the efforts of Sir Walter Rothschild. The latter specimen originally came from South Aldabra, was taken to Egmont Island, and thence to Mauritius, before being transferred to England. In *All About Animals*, p. 171, incidents in the history of this tortoise are assigned, in error, to the tortoise that figured in the treaty—or as the writer in *All About Animals* will have it, in two treaties—with the result that Aldabra is mentioned as the place of origin of the historic tortoise of Mauritius, instead of the Seychelles, its true birthplace. Through the same error, the historic tortoise is, in the account given in the volume mentioned, transshipped to England in 1897, although the very fact that it was regarded by Sir Hubert Jermy as Government property, and therefore not subject to sale, made such a transfer impossible. This tortoise remained at Port Louis, Mauritius, whereas the tortoise from South Aldabra is preserved today in the Rothschild Museum at Tring; the latter was certainly more than 150 years old at the time of its death, probably nearer 200, and enjoys the distinction of being, aside from fossil specimens, the largest known tortoise, having, it is reported, attained a weight of 560 pounds.

Still another Ancient of Days was a tortoise from the Galápagos, taken to Honolulu probably by some whaler during the golden days of the whale fishery, before 1850, and given to Paki, father of Mrs. Bernice Pauahi Bishop, by whom it was christened Maeleka. Some time before his death in 1855 he gave the tortoise to Queen Liliuokalani, who later placed it in Kapiolani Park. From there, at the instance of Sir Walter Rothschild, it was sent to England in 1915, where it died two years later.

These three "historic tortoises," so

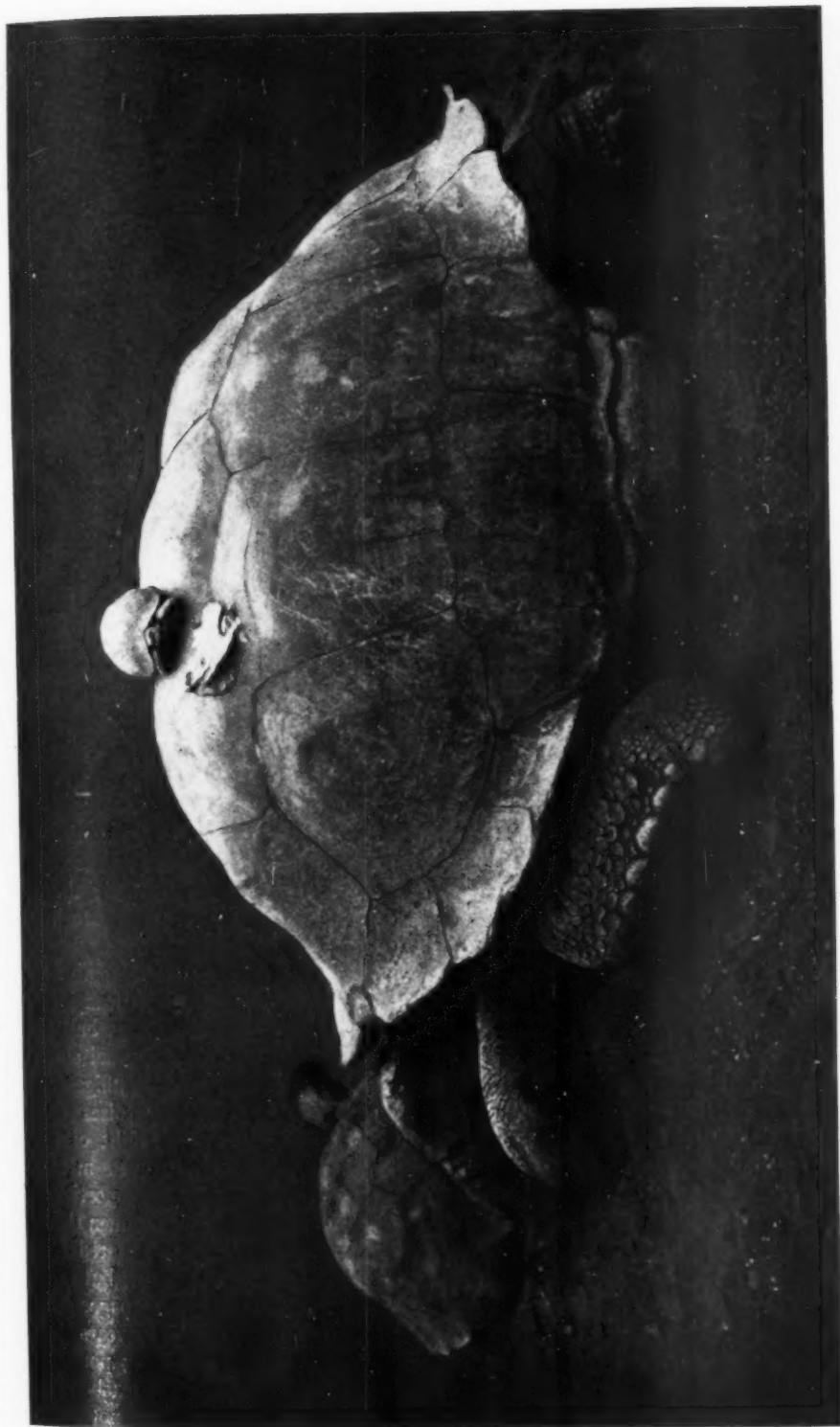
far as we can determine, attained the greatest ages recorded for any animals, being the oldest known members of an ancient and long-lived race, for even such little species as our box turtle reach a good old age. True, the most accurate record, that of an individual that was caught and marked from time to time, is only 41 years, but there is a rather reliable account of a tortoise 110 years old and a less reliable note of a specimen marked by Daniel Webster, though here I confess that I have lost the published account.

This naturally leads to the questions: what is the limit of life, what animals live the longest, and what is the age they attain?

There are plenty of statements that fish are known to attain, and birds have reached, many scores of years, but when an attempt is made to verify these statements, they resolve themselves into matters of hearsay or of belief rather than records of facts. We naturally associate size with age, for the bigger an animal, the longer should it take to reach that size, but while we are apt to credit such creatures as whales with a century or more of existence, there is reason to believe that they are by no means as venerable as they appear, and the same seems to be true of elephants, which reach their full stature in comparatively few years.

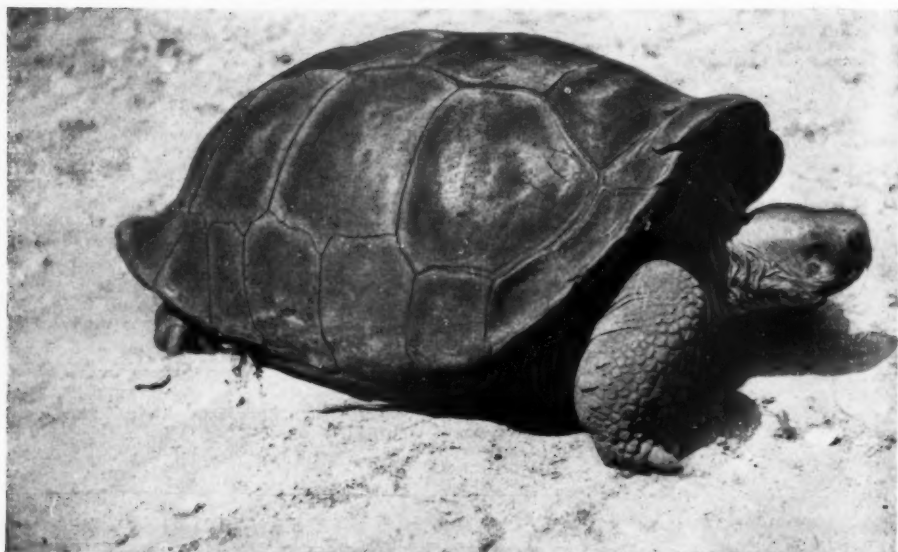
Thus, the once-famous Jumbo, whose name has been embodied in the dictionary as a synonym for all things big, reached his full height and weight in twenty-one years, growing in this time from an infant three feet high, weighing a few hundred pounds, to a towering adult eleven feet in height and weighing six and a half tons.

As for the Indian elephant, Mr. Pocock, from a study of the teeth, estimates the average duration of life at about seventy years and, so far, I have not been able to lay hands on an authenticated record of an elephant older than this, although these animals "are said" to attain an age of 120 years.



THE LARGEST RECENT TORTOISE

Exclusive of fossil specimens, this tortoise from South Aldabra, now preserved in the Rothschild Museum at Tring, is the largest known tortoise. At the time of its death it was between 150 and 200 years old and weighed, as recorded by Dr. Hans Gadow, 560 pounds. The history of this tortoise, as well as that of other noteworthy specimens, is given by Doctor Gadow in the volume *Amphibia and Reptiles* in The Cambridge Natural History



This tortoise lived for more than half a century after having been given to Queen Liliuokalani of Hawaii by Paki, the father of Mrs. Bernice Pauahi Bishop, being even then of so conspicuous a size that it was deemed a present worthy of royalty. It came originally from the Galápagos Islands, sojourned for many years in the Hawaiian Islands, was finally transshipped to England, and died there two years after its arrival.

Personally, I confess that I believed whales required many years, possibly one hundred, to reach their full growth, until I became somewhat intimately acquainted with them at Balaena, when my ideas underwent a radical revision. Briefly, if whales continued to grow indefinitely, there would be an infinite variety of sizes; as a matter of fact they fall into rather few categories and there are a not inconsiderable number of whales of moderate bulk that are, as shown by the condition of their bones, indubitably old, or at least adult. How long it takes to reach a length of 80 feet, with a known weight of 60 tons, or the maximum of 103 feet, and an estimated 80 to 90 tons, we know not, but the chances are that it takes far less time than is generally supposed.¹

There are some animals, or groups of animals, such as fishes and reptiles, that seem to have no fixed limits of life and

growth and thus appear to present great possibilities in the matter of age. Unfortunately, there are few records on which to base any trustworthy conclusions and the most reliable of these show that under favorable conditions some reptiles grow much more rapidly than is generally supposed: the big alligator in the New York Zoological Park grew from seven feet to twelve feet in length in twelve years, though theoretically it should have taken him at least half a century to attain such an unusual size, almost the maximum for an alligator.

The great size of the tortoises referred to, which reached a weight of *at least* 450 pounds, probably even more, was supposed to indicate a proportionately great age; in fact, a specimen that died at the London Zoo was stated by the papers to be 400 years old; but another, brought from the Galápagos by Mr. Edmund Heller, in seven years increased from 29 pounds to 295 pounds and in less than ten years reached a weight of 350 pounds. Had not the career of this tortoise unluckily been

¹Whales seem to reach their maximum size in the South Atlantic: examples of the "blue" or "sulphur-bottom whale," 105 and 108 feet in length respectively, have been reported from the whaling station at South Georgia, and the British Museum party measured specimens up to 103 feet long.

cut short by kidney trouble, induced by living for part of the year in a moist climate on damp ground, it might by this time have attained the record size for tortoises.

If reptiles grow so rapidly nowadays, they probably did so in the past, and *Brontosaurus* and his kindred may not have taken a century or two to reach their seventy or eighty feet of length, as has so often been supposed.

Mere size, then, is not a safe criterion of the age of either mammals or reptiles, and needs to be checked by a knowledge of the conditions under which the animals have lived.

Fish stories and fishy have become "familiar in (our) mouths as household words," so we are not surprised to find among the "it is said's" and "it is reported's" that fishes are credited with the greatest span of life ascribed to animals, pike and carp holding the places of honor with *reputed* ages of from 200 to 375 years. Oddly enough, most of these alleged records are reported from French ponds at Chantilly, St. Germain, and Fontainebleau, during the German occupation of 1870.

Records of birds are rather disappointing, for just as the greatest creature is apt to shrink before the application of a two-foot rule, and fish when weighed in the balance are often found woefully wanting in avoirdupois, so the ages of birds become wonderfully less when their claims to longevity are investigated.¹ Parrots stand well toward the head of the list, with numerous records on good authority of various species attaining an age of from fifty to eighty years. Geese and

swans, too, are long-lived, and include some possible centenarians, though just as the census returns show a part of womankind to be much younger than it looks, so there are few reliable records of swans more than seventy years old.

There have been many attempts to estimate the ages to which various animals might attain under favorable circumstances, but none of these estimates based on size, time required to reach maturity, period of incubation (in birds), is borne out by the known facts. The best of them is possibly that applied to mammals, that their normal life is five times that required to reach maturity, this being determined by the union of the epiphyses with their adjacent bones.

After all, man, when compared with other animals, does not suffer much in the matter of longevity, and frequently exceeds the threescore years and ten popularly ascribed to him, though he does not often reach the 120 years allotted in Genesis. In the *Times* for November 6, 1921, Mr. Buck, discussing the span of life, cites from recent death notices seven instances ranging from 102 to 115 years.²

In preparing this article I have become more than ever impressed with the truth of the adage that "there is no truth in history." To begin with, I cannot find that there is any such adage, the nearest approach to it being the remark, attributed to Plutarch, "So very difficult a matter is it to trace and find out the truth of anything by history," a remark to which I most heartily subscribe.

¹The statements in regard to the ages of birds are taken from an article by J. H. Gurney, on the "Comparative Ages to which Birds Live," which may be found in the *Ibis* for January, 1899. It was reprinted, with additions, in the *Osprey* for June, 1899, and the subject of longevity discussed by Doctor Gill on p. 157 of the same number.

²The reader is referred also to "The Biology of Death: I—The Problem," by Professor Raymond Pearl, *Scientific Monthly*, March, 1921. Professor Pearl points out (p. 198) that "the most extreme case of longevity which Young was able to authenticate was about a month and a half short of 111 years."



TERNS AND SKIMMERS

Among the most impressive of the bird habitat groups on the third floor of the American Museum is that representing the summer life of Cobbs Island, Virginia. A shell-strewn sand bar seven miles long, and about the same distance from the mainland, this island is an ideal resort for sea birds. Some years ago the bird-life of this island was appallingly depleted through the inroads of the millinery trade, but today it is recuperating. The birds of this habitat group, only a part of which is shown in the picture, were mounted by H. C. Denslow; the background was painted by W. B. Cox. (See page 315)

THE DEPARTMENT OF BIRDS, AMERICAN MUSEUM

ITS HISTORY AND AIMS

BY

FRANK M. CHAPMAN*

THE "large lecture hall" of the first (north) wing of the American Museum in which Professor Bickmore inaugurated his popular lectures to teachers, now holds about one half of the Museum's research collections of 200,000 birds, not one specimen of which was in the building when this hall was opened.

The first time I ever visited the American Museum I found that Sunday—the only day in the week I was free—was the only day in the week that the Museum was closed. Finally, during a vacation period, I entered the bird halls to discover only row after row of birds mounted in stereotyped attitudes on T-perches. Absorbingly interesting they were to me, but the average visitor wandered aimlessly past them. At present Sunday attendance at the Museum is often larger than the total for the remaining days of the week and, from the opening to the closing hour, the hall of habitat bird groups is thronged with keenly interested visitors. These facts give some idea of the growth and development of the Museum's research and exhibition collections of birds.

Without being unnecessarily statistical (the exact data may be found in the *Annual Reports*) let me attempt to present the history of the department which from nothing has attained the first rank in less than fifty years. It will be well, however, to preface this sketch with a word or two on the function of a department of birds, in order that the reader may have some conception of our aims and the measure of success that has attended our efforts to attain them.

AIMS OF A DEPARTMENT OF BIRDS

A museum department of birds should be prepared to answer, so far as existing knowledge permits, any inquiry concerning birds, their place in nature, and their relation to man. This it does primarily through its exhibits, illustrating the structure of birds, their classification and distribution, their habits, their food, and their relation to their environment and to man. There should be (a) synoptic collections showing leading types of birds arranged according to what are believed to be their natural relationships, and (b) faunal exhibits of birds, grouped according to the zoological regions they inhabit. This system not only enables the visitor to see at a glance the more characteristic birds of South America, Europe, or Africa, for example, but it permits him to find more readily a given species of a certain country.

First place among faunal exhibits of this nature should be given to one illustrating local bird-life designed especially to help teachers and amateur students. Such a collection, in addition to a systematic series, should include a seasonal one, to be rearranged the first of each month and to include only the birds that are then in evidence.

Accessory groups, including the nest and its immediate surroundings, will illustrate nest architecture in relation to site, and large habitat groups will show the bird and its surroundings, and will afford an opportunity to illustrate not only a bird's haunts but its nesting habits and the relation of its form and color to its environment.

A series of related groups should tell

*Curator of Birds, American Museum

The local bird collection at the American Museum consists of species found within fifty miles of New York City. It is divided into a systematic and a seasonal series, the latter being changed each month to conform to the development of the ornithological year. The student of local birds is thus enabled to look for a specimen of some species he has recently seen near New York among a few score birds rather than among 12,000. The local collection occupies several cases. Two representative shelves of one case are here shown



This case contains every kind of land bird regularly found this month within fifty miles of New York City. The bird list of this region changes greatly during the year. A few species called Permanent Residents are always with us; but most (Summer Residents) spend the summer and nest here, but winter south of our limits; some (Winter Residents) nest north of our limits and are here only from autumn till spring; and some (Transients) visit us only in the spring on the way to their northern nesting grounds and in the autumn on the way to their southern winter quarters.

The *in situ* Summer Branches is applied to those species which are known to spend the summer in the Spring near the young, and return to the South in the fall. Scattered Branches, often low, are present and absent during the summer months, but only present in July. February is usually March, and usually ends in November. As a rule, the first letters are given to the spring, the last to be born in the fall, while the later arrivals are given the first to depart.

Some of the same in the Spring or early April may present a month or more before beginning to nest, but those that come in May are often found to be building a few days after their arrival. (See *Guide to Lists* on page 106, page 12.)

the story of the growth of the individual bird within the egg, the history of the development of birds from their reptile-like ancestors, such as *Archæopteryx*, and should illustrate the structure of the more characteristic features of the bird, like the wing, foot, and bill, and the growth and structure of feathers, the bird's unique possession.

Smaller subjective groups should illustrate the relation between structure and habit, showing, for example, how a certain type of bill—that of the humming bird, hawk, or heron—is used to secure food. Changes in color with age, sex, season, and climate may be illustrated; the manner in which they are accomplished should also form the subject of small groups.

Groups showing the food of birds and their economic value to man as destroyers of insects and rodents, and as devourers of the seeds of weeds should be given special prominence, and they may be supplemented by others illustrating some of the results of artificial selection in developing breeds of fowls and pigeons from the wild ancestral type.

There should be maps to illustrate the distribution and migration of birds, and photographs from nature showing the birds in their haunts. Specimens mounted with wings spread or in special poses should serve as models for artists, sculptors, and illustrators.

The eggs of local birds may be shown in their nests, but the facts to be learned from a study of birds' eggs may best be illustrated by a synoptic or subjective collection. Exhibits should not only be scientifically accurate and informing but artistically pleasing, and designed to arouse and hold the attention of the visitor. They should, of course, be adequately labeled, and so far as language and typography permit, the label should be as attractive as the exhibit.

Neither exhibits nor labels, however, can tell the whole story of bird-life. The duty that a museum department of birds owes to the public does not, there-

fore, end in its exhibition halls. The departmental staff should be prepared to meet all calls for information regarding birds and bird-life. Such requests may come from beginners in bird study or from professional ornithologists; from artists, authors, explorers, sportsmen, or game protectors, and may cover every known and many unknown phases of the subject, but so far as possible, each inquirer should be given the information he seeks.

The above is an outline merely of the functions of a museum bird department. Its measure of success in performing them will depend primarily upon the character and size of its staff. Before speaking of the collections of the American Museum it will be well, therefore, to say a word or two about those who are in charge of them. The duties of the staff, in the field and in the study, will appear as the history of the department is recorded.

PERSONNEL OF THE DEPARTMENT

One can conceive of a department of birds with curators and without specimens, but the largest collection of birds without an ornithologist to study it or exhibit it would be as useless as the minerals of an unworked mine. In other words, live men are worth more than dead birds.

There were specimens of birds in the American Museum in 1877, but there was no department of birds until Dr. J. A. Allen was called from the Museum of Comparative Zoölogy to form one in 1885. Prior to this time the trustees had availed themselves of the expert services of Dr. Daniel G. Elliot to purchase mounted birds in Paris, and Robert Ridgway had been employed to name them. Dr. E. A. Mearns and Dr. A. K. Fisher worked as volunteers for a brief period in cataloguing specimens, and Mr. H. B. Bailey performed a like task with the collection of eggs that had been purchased from him. But the depart-

ment of birds did not actually come into existence until Doctor Allen was appointed its first curator on May 1, 1885. At that time it was known as the department of mammalogy and ornithology.

Nearly three years later, March 1, 1888, the writer was appointed Doctor Allen's assistant and the virtual separation of the department of birds, as an independent division, occurred with the promotion of the writer to the rank of curator in 1908. In 1904 Waldron DeWitt Miller joined the staff, and he was followed in 1906 by Robert Cushman Murphy, who left in 1907 to enter Brown University, and, after serving as curator of the department of natural sciences in the Brooklyn Museum, returned to our department of birds in 1921. In 1907 James P. Chapin became our representative on the Congo Expedition, but his actual addition to our scientific staff was not made until his return from Africa in 1914. In 1913, Charles H. Rogers entered the department, resigning in 1920 to become curator of the Museum of Princeton University, his Alma Mater. His post in charge of exhibition collections is now filled by Ludlow Griscom, who has been with us since 1917.

This is obviously not the place to comment on the Museum's equipment in the personnel of its department of birds, but at least it may be said that four of its members are among the fifty Fellows of the American Ornithologists' Union. A list of the members of the staff with the year in which each one entered the employ of the Museum is appended:

- 1888 Frank M. Chapman, curator.
- 1920 Robert Cushman Murphy, associate curator, in charge of marine ornithology.
- 1903 Waldron DeWitt Miller, associate curator, in charge of North American ornithology, structural and systematic problems.
- 1907 James P. Chapin, assistant curator in charge of Old World ornithology.
- 1917 Ludlow Griscom, assistant curator in charge of Middle American and local ornithology.
- 1921 Jonathan Dwight, research associate in North American ornithology.

- 1918 Mrs. E. M. B. Reichenberger, research assistant in Neotropical ornithology.
- 1908 Mrs. Alice K. Fraser, secretary, in charge of files and records.
- 1921 Mrs. E. B. Bardwell, secretary.
- 1917 Joseph Zuckerman, clerk.

THE RESEARCH COLLECTIONS

Collections are acquired by purchase, by exchange, by gift, and through expeditions.

Research or study collections, composed of unmounted birds' skins, are the tools of the ornithologist. Mounted birds cannot be examined satisfactorily, and when exposed to light, their color often changes so materially that their scientific value is largely impaired. The technical studies of the ornithologist are, therefore, made with birds' skins, which are kept in light-tight, moth-proof cabinets. He also requires skeletons and specimens preserved in alcohol or in formalin.

For the purposes of exhibition a pair of each species is often sufficient, but for study each species should be represented by a series of specimens showing (a) its variations with age from the time it leaves the egg until it is fully mature; (b) its sexual variations; (c) its seasonal variations, showing the changes in color which may occur throughout the year, the molts and other processes by which they are accomplished; (d) its distribution; (e) its changes in color, size, or form with locality. Birds are often exceedingly responsive to the influences of their environment, and a study of their characters in relation to the conditions (chiefly climatic) under which they live have thrown much light on the factors affecting the more recent phases of their evolution.

A study of the migrations and the distribution of birds must be based in part on specimens, the examination of which eliminates the probability of misidentification and places records of occurrence on a firm scientific foundation. A large and carefully selected series of specimens

of a species is required to enable the ornithologist to study its characters and their variations with age, sex, season, and environment, its migrations and distribution. The value of a study collection is determined, accordingly, not so much by its size as by the care that has been exercised in securing specimens to illustrate fully a bird's structure, color, and life history. Only when a museum is in possession of adequate research collections can its curators properly fulfil their functions in planning exhibits, in supplying information, and in advancing the science of ornithology.

When Doctor Allen came to the Museum, there was only the nucleus of a study collection of birds, and in response to his urgent recommendation the trustees purchased the historic Lawrence collection of 8000 specimens in 1887, which laid the foundation of our present splendid research series. Additional purchases were the Scott collection, 2400 specimens from Arizona in 1886, the Herbert Smith collections, 6000 specimens from Matto Grosso, Brazil, and 3000 specimens from Santa Marta, Colombia, in 1899, the Sennett collection, 9000 specimens, in 1904, and the Richardson Nicaragua collection, 3000 specimens, in 1908.

Meanwhile Dr. Daniel G. Elliot had presented to the Museum the collection of 2000 humming birds on which his monograph of this family had been based and Dr. E. A. Mearns had contributed a beautifully prepared collection of 5000 specimens from Arizona and Minnesota; in 1895, through the Linnaean Society of New York City, we received the Dutcher collection of 2500, chiefly Long Island birds; and in 1920 Mr. Frederick F. Brewster presented us with 2000 land birds collected for him by Mr. R. H. Beck in South America, including a number of species new to science and many new to the Museum.

While it is clear, therefore, that study collections of great scientific value may be acquired by gift and purchase, the

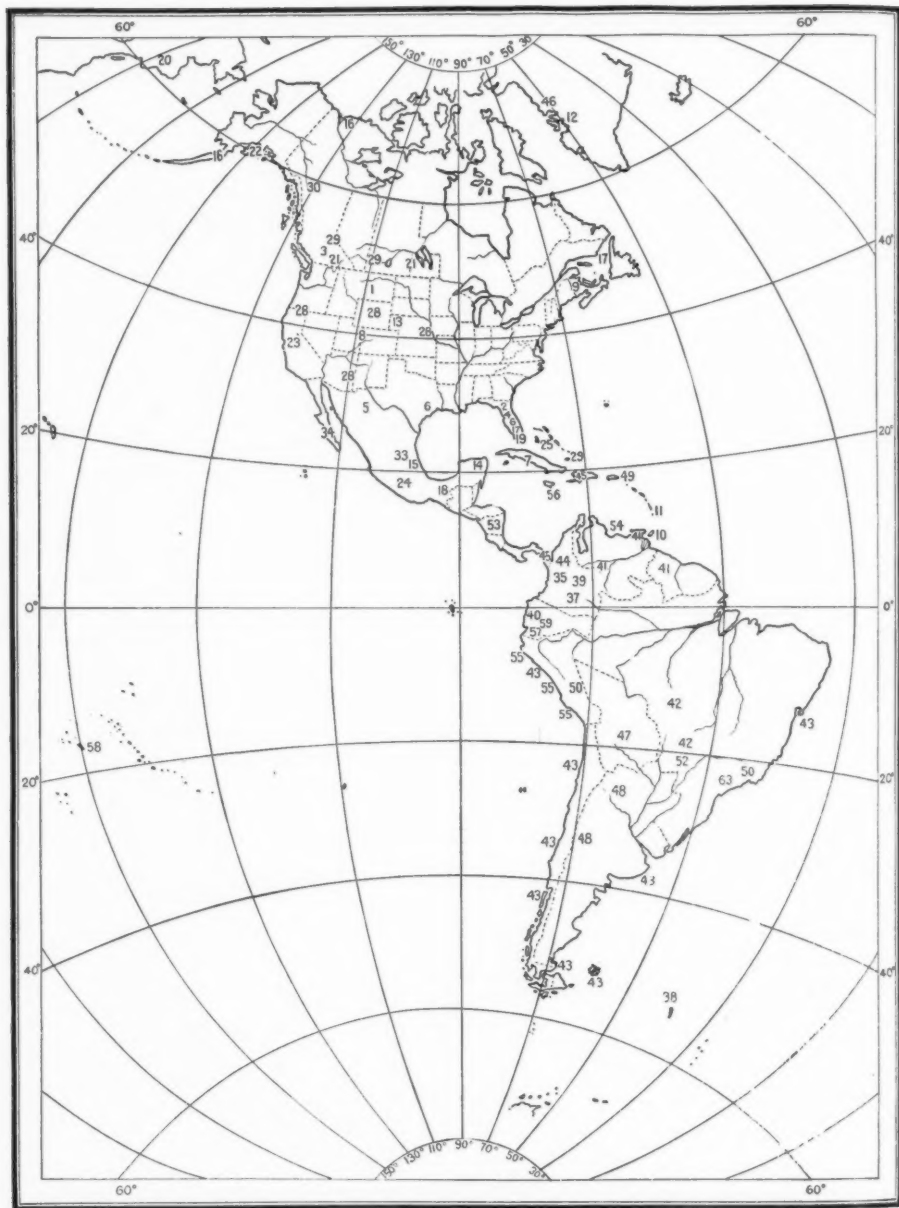
aims of original research may best be served by sending out expeditions with definite problems in view, led by, or under the direction of, men who will attempt to solve them. A specimen is of far greater value to the man who is familiar with the country whence it comes and the conditions under which it lives, than to one who has no first-hand knowledge of these most important factors. It is, therefore, the policy of the Museum to give its curators wide field experience, knowing well that this will result not only in better collections, but in more discriminating reports upon them.

The explorations of the department began two years after its formation, and have covered a large part of the world. Their record is presented here in barest outline.

EXPLORATIONS OF THE DEPARTMENT

(THE NUMBERS ASSIGNED TO THE EXPEDITIONS
CORRESPOND WITH THOSE ON THE
MAP, P. 312)

- | | |
|------------|--|
| (1) 1887 | Montana: D. G. Elliot, Jenness Richardson. Mammals and birds. |
| (2) 1889 | Florida: F. M. Chapman. Birds and mammals. |
| (3) 1889 | British Columbia: C. P. Streater. Birds and mammals. |
| (4) 1890 | Florida: F. M. Chapman. Birds and mammals. |
| (5) 1890-1 | Northern Mexico: Lumholtz Expedition. F. Robinette. Birds and mammals. |
| (6) 1891 | Florida; Southeastern Texas: F. M. Chapman. Birds and mammals. |
| (7) 1892 | Cuba: F. M. Chapman. Birds and mammals. |
| (8) 1892 | Colorado; Utah: C. P. Rowley. Birds and mammals. |
| (9) 1893 | New Brunswick: J. Rowley. Mammals and birds. |
| (10) 1893 | Trinidad, B. W. I.: F. M. Chapman. Birds and mammals. |
| (11) 1894 | Dominica, W. I.; Trinidad, B. W. I.: F. M. Chapman. Birds and mammals. |
| (12) 1895 | Greenland: Peary Relief Expedition. L. L. Dyche, Travis, J. D. Figgins. Mammals and birds. |
| (13) 1895 | Kansas; South Dakota: W. W. Granger. Birds and mammals. |
| (14) 1896 | Yucatan and Eastern Mexico: F. M. Chapman. Birds and mammals. |



ORNITHOLOGICAL EXPEDITIONS IN THE WESTERN HEMISPHERE

The extent of territory in the New World covered by the expeditions sent out by the department of birds, American Museum, either unassisted or in cooperation with other departments of the Museum or with other institutions, is indicated in this map. The expeditions are arranged in chronological order, the numbers on the map corresponding with those in the accompanying table. A map of the world would, however, be required to indicate all of the regions explored ornithologically by the department. Bird collecting in the interests of the department is, for instance, now in progress throughout Polynesia and in Australia as well as in other localities of the Old World.

- (15) 1897 Vera Cruz, Mexico: F. M. Chapman. Birds and mammals.
- (16) 1897 Alaska and Arctic Coast: A. F. Stone. Birds and mammals.
- (17) 1898 Florida: F. M. Chapman. Birds. Gulf of St. Lawrence: F. M. Chapman. Bird Rock Group.
- (18) 1900-1 Southern Mexico: A. E. Colburn. Birds and mammals.
- 19) 1900 Florida: F. M. Chapman. Birds.
- (20) 1901 Eastern Siberia: N. G. Buxton. Birds and mammals.
- (21) 1901 Manitoba, British Columbia: F. M. Chapman. Small bird groups.
- (22) 1901-3 Alaska; British Columbia: A. J. Stone, J. D. Figgins. Birds and mammals.
- (23) 1903 California: Los Baños and Cormorant Habitat Groups. F. M. Chapman, J. Rowley, Carlos Hittell.
- (24) 1903-6 Mexico: J. H. Batty. Birds and mammals.
- (25) 1904 Florida: Sandhill Crane Group; Bahamas; Flamingo Group. F. M. Chapman.
- (26) 1905 Florida: Water Turkey; Ward's Heron Groups. F. M. Chapman.
- (27) 1906 British East Africa: Tjader Expedition. H. Lang. Mammals and birds.
- (28) 1906 Nebraska: Prairie Chicken Group. Arizona: Desert Group. Wyoming: Golden Eagle Group. California: Condor Group. Oregon: Klamath Lake Group. F. M. Chapman, J. D. Figgins, R. Bruce Horsfall, Carlos Hittell.
- (29) 1907 Bahamas: Booby-Frigate Bird Group. South Carolina: White Egret Group. British Columbia: Canadian Rockies Group. F. M. Chapman, R. Bruce Horsfall, L. A. Fuertes.
- (30) 1908 Alaska and Northwest Territory: R. M. Anderson. Birds and mammals.
- (31) 1908 Florida: Cuthbert Rookery Group. F. M. Chapman, L. A. Fuertes.
- (32) 1907-14 Belgian Congo, Africa: Herbert Lang, J. P. Chapin. Birds and mammals, and other branches.
- (33) 1910 Yucatan, Vera Cruz, Mexico: Orizaba Group. F. M. Chapman, L. A. Fuertes.
- (34) 1911 Lower California: C. H. Townsend, H. E. Anthony, P. I. Osborn. Birds and mammals.
- (35) 1911 Colombia, Cauca Valley region: F. M. Chapman, L. A. Fuertes, W. B. Richardson, L. E. Miller. Birds and mammals.
- (36) 1911-12 Korea: Roy C. Andrews. Mammals and birds.
- (37) 1912 Southern Colombia: L. E. Miller, A. A. Allen. Birds and mammals.
- (38) 1912-13 South Georgia, Subantarctic Atlantic: Robert Cushman Murphy. (Jointly with the Brooklyn Museum.) Birds and mammals.
- (39) 1913 Colombia, Bogotá region: F. M. Chapman, L. A. Fuertes, G. K. Cherrie. Birds and mammals.
- (40) 1913 Western and Southern Ecuador: W. B. Richardson. Birds and mammals.
- (41) 1913 Venezuela; British Guiana: L. E. Miller. Birds and mammals.
- (42) 1913-14 Southern Brazil (Roosevelt Expedition): G. K. Cherrie, L. E. Miller. Birds and mammals.
- (43) 1913-17 South America; West Indies: R. H. Beck. Birds.
- (44) 1914 Northwestern Colombia: L. E. Miller, Howarth Boyle.
- (45) 1914-15 Panama: H. E. Anthony; David Ball, W. B. Richardson. Birds and mammals.
- (46) 1914-17 Greenland: Crocker Land Expedition. W. E. Ekblaw. Birds.
- (47) 1915 Northwestern Colombia; Bolivia: L. E. Miller, Howarth Boyle. Birds and mammals.
- (48) 1916 Bolivia; Northwestern Argentina: L. E. Miller, Howarth Boyle. Birds and mammals.
- (49) 1916 Porto Rico: N. Y. Academy of Sciences Survey. H. E. Anthony. Birds and mammals.
- (50) 1916 Urubamba Valley, Peru; Organ Mts., Brazil: F. M. Chapman. Reconnaissance, Ecuador, Bolivia, Chile, Argentina. Birds.
- (51) 1916-17 Province of Yunnan, China: Roy C. Andrews. Mammals and birds.
- (52) 1916-17 Southern Brazil: George K. Cherrie. Birds.
- (53) 1917 Nicaragua: W. DeW. Miller, Ludlow Griscom, W. B. Richardson. Birds.
- (54) 1918 Northern Venezuela: G. K. Cherrie. Birds.
- (55) 1919-20 Coast of Peru (Jointly with Brooklyn Museum): Robert Cushman Murphy. Birds, fishes, etc.
- (56) 1919-20 Jamaica: H. E. Anthony. Birds and mammals.
- (57) 1920-21 Southern Ecuador: H. E. Anthony, George K. Cherrie. Mammals and birds.
- (58) 1920 Central Polynesia: R. H. Beck, E. H. Quayle. Birds.
- (59) 1921 Southern Ecuador: George K. Cherrie; G. Gill; H. H. Tate. Birds and mammals.
- (60) 1921 China: Roy C. Andrews. Mammals and birds.
- (61) 1921 Australia: H. C. Raven. Mammals and birds.
- (62) 1921 Azores: J. G. Correia. Birds.
- (63) 1921 Southeastern Brazil: E. G. Holt. Birds.

The collections acquired through these expeditions include, of course, many duplicate specimens, which, after they have been studied, are exchanged with other museums for species inadequately or not at all represented in our collection.

In this manner the department secures much material that is valuable scientifically and historically. For example, the curator of the department during a recent visit to England secured by exchange with the British Museum and Lord Rothschild's museum at Tring, no less than 136 species not heretofore represented in our South American collections.

Finally, the working value of our research collections is enormously increased by the deposit in the Museum of the private collections of Dr. Jonathan Dwight, Dr. L. C. Sanford, and Mr. Frederick F. Brewster, which form as much a part of our scientific equipment as do the specimens contained in our own collections.

EXHIBITION COLLECTIONS

The character of a museum's exhibits in any branch of natural history will reflect the attainments of its scientific staff, the opportunities they have had for research, and their interest in presenting the known facts of their subject to the public. The degree of accuracy shown in the identification of specimens, the amount of skill manifested in arranging them to illustrate their structure, relationships, distribution, and habits, the success attending the planning and preparation of special groups, are expressions of the curator's experience and knowledge as well as of his ability to understand the public's point of view.

When the Museum was established, the trustees, represented by Dr. D. G. Elliot, purchased from Verreaux Frères, natural history dealers in Paris, a notable collection of 6000 mounted birds, representing most of the known types. Dr. Elliot, still acting for the trustees, also bought the mounted collection of Prince

Maximilian of Wied, consisting chiefly of Brazilian birds collected by that explorer. The two combined, with the collection presented by Dr. Elliot, the Sanford collection of North American water birds, deposited by Dr. L. C. Sanford in 1910, and the collection of birds of paradise presented by Mrs. Sturges in 1905, form the greater part of the general exhibition collection of the department. From time to time previously unrepresented species have been added until the total is now about 12,300 specimens.

These birds are placed in two collections: first, a synoptic collection of the birds of the world; second, a faunal collection. The synoptic collection permits the student to compare the African ostrich with the South American rhea, for example; the faunal collection enables him to gain some conception of the general character of the bird life of the major zoölogical realms.

With the establishment of a department of preparation in 1886 under Jenness Richardson, the Museum made its first attempt to present bird exhibits other than those of specimens on T-perches, by the preparation of what is known as "accessory groups." These groups show the bird with its nest *in situ* and its immediate surroundings. The earlier groups in this series (robin, wood thrush, etc.) were prepared by Mrs. E. S. Mogridge, and her brother, Mr. Minturn, who had made similar exhibits for the natural history branch of the British Museum in Cromwell Road, and from them the members of our staff learned the art of making artificial vegetation. The groups in this series now represent all of our more common and some of our rarer breeding birds, some from the western states, and a number of interesting foreign species, like the hornbill of Africa and the ani of tropical America.

A further departure from current museum methods was the installation in 1894 of a local bird collection, containing

only the species found within fifty miles of New York City. This includes both a systematic and a seasonal series, the first containing all the local birds, the second only those of the month (page 308). As the birds come and go in their migrations, they are added to or taken from this seasonal collection, which, therefore, not only gives one at a glance a picture of the bird-life of the moment, as it were, but, by elimination, enables the local student to look for a specimen of some species he has recently seen near New York among a few score birds rather than among 12,000.

The group showing almost in facsimile a portion of the historic Bird Rock in the Gulf of St. Lawrence was made in 1898 and marks the transition between the accessory group and the habitat group, with its panoramic background. The first habitat group, showing the bird-life of the beach on Cobbs Island, Virginia, was made in 1902, and with the support of a number of friends of the Museum, led by the late John L. Cadwalader, the series was added to during the succeeding ten years until the hall assigned to it was filled.

Habitat groups are based on original field studies by ornithologist, artist, and preparator. The backgrounds, painted by R. Bruce Horsfall, Carlos Hittell, Hobart Nichols, Carl Rungius, and Walter B. Cox, with birds by Louis A. Fuertes and R. Bruce Horsfall, are realistic productions of definite localities, and thus in themselves possess a scientific value, as they depict not only the home of the bird shown with them, but characteristic American scenery from the Atlantic to the Pacific, from the table-land of Mexico to the barren grounds within the Arctic Circle. Habitat groups established a new standard in the exhibition of birds and they constitute one of the Museum's most important contributions to methods in this field.

At intervals special groups have been prepared to illustrate certain facts in bird-life; for example, the development

of the chick, protective coloration, geographic variation, methods of securing food, habit, structure, etc. This series may be indefinitely expanded, but lack of space has forced the department to abandon for the present its elaborate schemes for the development of its exhibition collections. We want especially to illustrate the economic relations of birds through the nature of the food they consume, the flight of birds, and the more significant facts of their evolution; but until the erection of a new building permits the removal of the exhibits of other departments from our halls, we can make no progress with our plans.

The subject of exhibition collections should not be left without a word in regard to our relations with the department of preparation. While in museum organization such a department is usually a distinct unit, it is so closely connected with the departments it serves that it becomes, in effect, a part of them. Certainly the department of birds owes much to the coöperation of the department of preparation for its share in the mounting of the exhibition collections; and it is well to record here our indebtedness to Jenness Richardson (1886-91), John Rowley (1892-1904), J. D. Figgins (1897-1910), Ernest W. Smith (1916-17), H. C. Denslow (1901-2), and their assistants. To their skill and artistic ability we must attribute the success which has attended our efforts to bring the bird and its haunts into our exhibition halls.

THE RESULTS OF RESEARCH

The principal, if not the sole, duty of the ornithologist is commonly believed to consist of "stuffing birds," but it has been shown, I hope, that something more than a knowledge of taxidermy is required to plan and successfully develop exhibition collections that will illustrate the bird's place in nature and the known facts of its history.

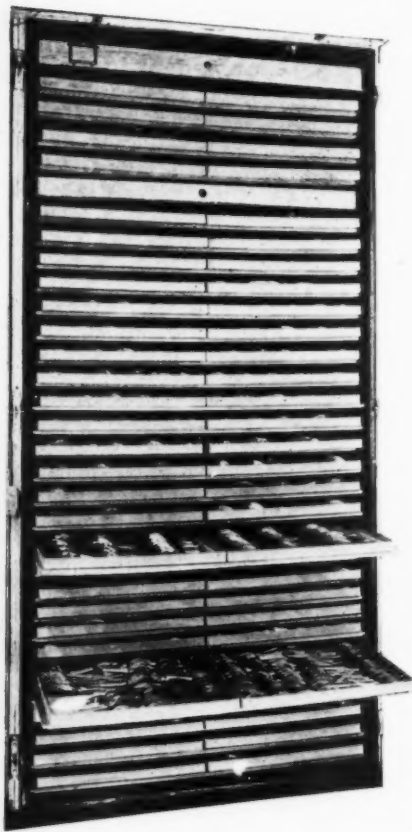
The efforts of the Museum's ornitholog-

ical staff, however, are not exclusively devoted to the arrangement of exhibits. Let us, therefore, visit the laboratories of the department of birds and learn what are the actual duties of the professional ornithologist.

The building up of a well-rounded collection of specimens, with certain definite

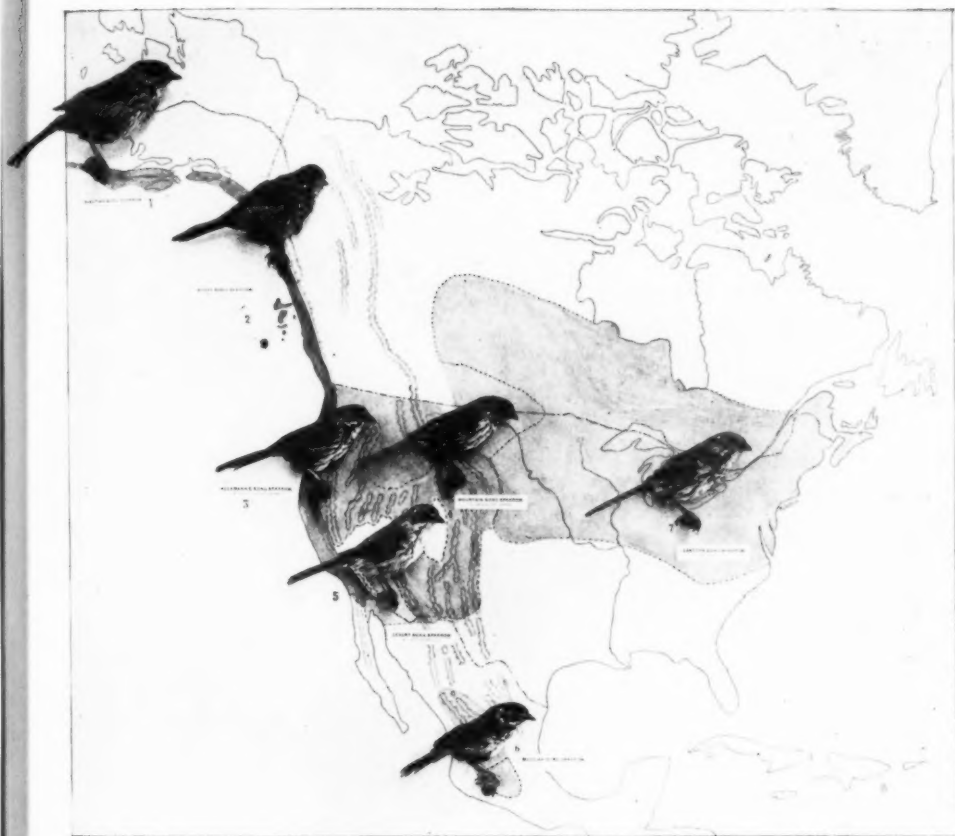
fully considered, and by as frequent communication as circumstances permit their work is being directed by the member of the staff concerned. When the specimens finally arrive at the Museum in the shape of study "skins," which look very much like dead birds, they must be catalogued and named. To be prepared to name any one of the 18,000 or more different species and subspecies of birds found in the world and to give new names to those which have not before been described, requires so special a training and so wide a knowledge of the vast literature of ornithology that it forms a distinct branch of the study of birds, and the expert skilled in the practices of classification is known as a systematic ornithologist, or systematist. Whatever be the bird student's special field, his work must be preceded by this naming of the specimens, the "giving of a handle" to the fact of their identity. This accomplished, he may direct his attention to any one of the numberless problems which confront the student of bird-life.

Birds are not only "eloquent expressions of nature's beauty, joy, and freedom," but also of the workings of natural laws; and study of them has contributed in no small degree to our knowledge of the laws governing the evolution and distribution of life. Through the intensive studies of the ornithologist, much definite information has been acquired of the relation between a bird's color characters and the climatic conditions under which it lives, and these discoveries have an important bearing on the evolution of species by environment. A study of the distribution of birds based on large and carefully identified collections has assisted the zoögeographer in mapping the boundaries of natural life areas, in determining past continental relations, and the origin of the altitudinal zones of life found on higher mountain ranges. A study of the remarkable journeys made by birds in traveling between their winter and their summer homes, of their architectural instincts, and of all the



The study collections of the department of birds, American Museum, are arranged in trays that fit into fireproof steel storage cases of this type

objects in view, calls for a knowledge of geography, as well as of the needs of ornithology. At present the bird department has expeditions in Ecuador, Peru, Polynesia, Australia, Cape Verde Islands, and China. Before they took the field the problems in mind were care-



The exhibit of song sparrows in the American Museum illustrates their variation in size and color in response to the influences of environment.

Note that the smallest race or subspecies (*Melospiza melodia mexicana*) is found at the most southern part, the largest (*Melospiza melodia kenaiensis*) at the most northern part of the range of the species; also that the palest colored race (*Melospiza melodia jallax* of the Colorado Desert) is found in the most arid region, while the darkest colored race (*Melospiza melodia cinerea* of the Northwest Coast) inhabits the most humid region. Twenty-odd races of song sparrows are known, all of which are believed to intergrade with their neighbors as the climatic conditions of the areas they inhabit merge with those of adjoining areas.

other phenomena of the nesting season, must also be preceded by the identification of the species concerned.

Further idea of the nature of the researches of the professional ornithologist may be gained from the long list of published works by the members of our staff. To the reader who believes in the value only of applied science, it may be said that these written records of our work form a portion of the framework which supports the visible structure of ornithology as he sees it in our exhibition halls or in the many popular works which

have helped to make birds a part of our lives. Ultimate results are not gained in a step, and much labor is often required before a theory becomes a fact.

THE BIRD DEPARTMENT AS A BUREAU OF INFORMATION

By no means all the curator's time is given to research in field and study, or to the planning of exhibits and the supervising of their preparation. The store of information which he has gathered is made available to the public, not only

through exhibitions and publications, but by interviews and correspondence. There are days when an unending stream of visitors comes to the department of birds in search of information concerning birds, or in regard to the countries in which it is known that members of our staff have explored—and this includes the greater part of the earth's surface. A further and very heavy drain upon our time is made in replying to thousands of letters which are received yearly. Add to this the preparation and delivery of lectures upon the results of our work in the field and in the laboratory, and it will be seen that the department is a bureau of ornithological information.

Without mentioning the part taken by members of the department staff in the

proceedings of scientific societies, in the work of various organizations designed to promote the protection and study of birds, and in coöperating in a variety of ways with their colleagues throughout the world, it is hoped that this brief review of the more important activities of the department shows that, to some extent at least, it has attained the objects for which it was formed. If we are still far from reaching the standards toward which we aim, we trust that the construction of a new building, with the resulting increased space in exhibition halls and laboratories, will add greatly to the number, beauty, and instructiveness of our exhibits, to the value of our scientific work, and to the effectiveness of our services to the public.

A NEW BOOK ON LONG ISLAND

The Evolution of Long Island—A Story of Land and Sea, by Professor R. H. Gabriel of Yale, has recently been issued by the Yale University Press.

Taking Long Island as a unit of space which has for long ages been on the border line between land and sea, Professor Gabriel shows clearly how human development in the region has been controlled very largely by the same cosmic circumstances responsible for the type of vegetation and native animal life.

Beginning with an account of the geologic and climatic setting, the author sketches in successive chapters the struggle for existence from the first settlement of the eastern end of the island by pioneers from New England, and their gradual spread westward until they came into contact with the Dutch settlers at the end nearest New York. The author then carries us through the slow and painful changes in agricultural methods, caused by the influence of the hinterland and the growth of the great metropolis just beyond the western end of Long Island; and then, one after another, he describes the various trades and callings which have drawn the youth of the region toward or away from the sea. Whaling voyages, the era of menhaden fishing

with its growing coöperation which ended in monopoly, the progress of the oyster fisheries with its increasing complexity, the clam and scallop industries, piracy, smuggling, ship-building, etc., are all treated in turn. Chapters of great interest are devoted to the inception and development of the Long Island Railroad system and to the construction of modern roads, which have made the territory everywhere penetrable both to industry and to pleasure seekers, and which have been coincident with what Professor Gabriel calls the "discovery of the out-of-doors."

The varied geographical character of Long Island, with its exceptionally long shore line facing on both ocean and inland sound, its lagoons and broad meadows, its glaciated and forested northern shore and its extensive "pine barrens," makes it a peculiarly interesting region for a broad philosophical study such as Professor Gabriel has prepared, and his work is a notable contribution to history of the new type. His problem has been to trace the development of a people as it has been affected not by its social and economic conditions but by its *natural surroundings*.

—R. C. M.



FROM A PORTRAIT IN RELIEF OF THE ILLUSTRIOUS FRENCH ENTOMOLOGIST
By T. Spicer Simson

A PILGRIMAGE TO THE HOME OF FABRE

BY
L. O. HOWARD*

PROBABLY no writer on natural history topics has ever had a larger audience than Jean Henri Fabre, the illustrious Frenchman who died at Serignan in 1915. His books have been translated into many languages and, since his death especially, have had an enormous vogue in the United States; so that I am probably safe in supposing that in preparing this article I am addressing people who know his writings and love them.

My own attitude toward the close observer and charming writer may be gathered from the fact that I have called the visit which I made to Harmas in 1920 a "pilgrimage," a word which has come to have an especial meaning which includes the idea of reverence.

In June, 1920, I was in the south of France, in company with the famous entomologist, Dr. Paul Marchal of Paris, and his assistant, Mr. P. Vayssière, engaged in watching the operations then going on against the Moroccan locust, a very interesting experience for me, since French soldiers had been loaned to the organization of farmers to help in the fight and they were using army flame-throwers against the grasshoppers with much success. One night we were sitting in the hotel at Arles (the former home of Mistral, the famous Provençal poet), looking over the maps of the region, and my eye caught the name "Serignan"; whereupon I proposed that we visit the old home of Fabre provided our next day's route should take us in

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that general direction. So the next morning we started out in a Ford of the model of 1913, which had served through



Photograph by L. O. Howard

Demoiselle Fabre, the daughter of the "Insect Homer," in the garden at "Harmas"

the war and had been placed at our disposal by the French government. We

passed through Tarascon and a number of smaller villages for a distance of about ninety kilometers, reaching the village of Serignan about eleven o'clock. The country was charming, rolling in character, with densely shaded roads, lined for the most part with *Platanus* trees and in some places with poplars. Wheat, oats, grapes, and olive orchards bordered the road.

As it happened, Vayssière's grandmother lived in the neighborhood, and his father had lived there and had been a personal friend of Fabre; so that our companion knew the country well.

Serignan is a typical south of France village, with nothing that especially distinguishes it from many others. It is not on the railroad, the nearest station being Orange, about seven miles away. Passing through the main street of the little town, we deviated at a slight angle into a narrower street of little shops and stone houses, and it was interesting to note on the signpost that it was known as the Street of Henri Fabre (*Rue de Henri Fabre*). I think that it is the only street in the world named after an entomologist. A short distance farther on we came to the smaller villa district, and on a corner was apparently a rather large estate surrounded by a very high wall. We dismounted, rang the bell at the gate, and presently heard slow, approaching footsteps. The gate was opened by a little, old, bent, gray-haired woman, apparently between sixty and seventy years of age, whom Vayssière addressed as Demoiselle Fabre; and he was recognized in turn when he mentioned his name. He introduced Marchal and myself, and the introduction was acknowledged very quietly without a smile or without any especial cordiality, as though it were a quite-to-be-expected thing that eminent scientific Frenchmen and foreign men of science should call to see her father's house.

Although Demoiselle Fabre is very small, her father was a tall man, which is contrary to the impression one gains



Photograph by L. O. Howard

FRONT VIEW OF FABRE'S HOUSE

On acquiring this property after years of hard work and self-denial, Fabre referred to it as Eden, for to the bees and the wasps it was "an earthly paradise" and hence no less so to the entomologist



Photograph by L. O. Howard

A DETAIL OF FABRE'S HOUSE

Glancing up to the second story, one sees one of the heavily-shuttered windows of the workroom, which enshrines mementos innumerable of Fabre's activities

from the pictures which have been published in this country and England, for the latter were taken when he was very old, emaciated, and bent, and all show him seated.

Demoiselle Fabre asked us to step inside, and Vayssière told her we should like to see the house and the garden and the laboratory where Fabre worked during his later years. Contrary to the usual French custom, she made no effort to entertain us by offering a glass of wine, but showed us the stairway leading to Fabre's principal workroom and left us to do as we pleased.

The house is a good one, hardly beautiful, with a square principal portion two stories in height, and an L, also two stories but lower than the main building. The house is built of stone and covered with yellow plaster. The floors throughout are of wood and uncovered. The second story workroom is in the L and is about 15 by 20 feet in size. It is really a small museum, containing a collection of fossil shells in wall-cases placed on two sides and a herbarium on top of the wall-cases. In the middle of the room is a plain, eight-foot wooden table, with bell glasses and specimens of insects in differently shaped boxes, and some odd specimens of insect work. There is an open fireplace at one end of the room and an old desk in the corner. The room has two windows with panes painted white and heavy wooden shutters. Between the windows, which look out into the large garden, there are two shelves supporting cans, jars, and bottles, all containing specimens. On the desk were a few simple instruments—pinning forceps, a scalpel, some dissecting needles, and a primitive magnifying glass.

In the main part of the house, next to the broad hallway, was the darkened parlor, and on the walls were a dozen or more enlarged photographs and portraits of Fabre. Between the two windows on one side of this parlor was a large bookcase containing books on entomology as well as zoölogy in general

and botany, and in this case were a number of different editions of Fabre's monumental work, *Souvenirs Entomologiques*. Demoiselle Fabre, who had rejoined us, called our attention with much pride to the illustrated, definitive edition published in 1914 by Delagrave, the illustrations of which, she told us, had been made largely by her brother, who assisted in the editing. She brought out a leather-bound visitors' book and asked us to register our names. She told us that Fabre had lived in this house for thirty-eight years.

The garden is a large one, covering, I should judge, somewhat less than an acre, and is almost a luxuriant jungle. Near the house is a pool made of masonry, in which grow aquatic plants; here Fabre studied his aquatic insects. The garden was originally planted with shrubs from all of the surrounding region, including some from the foothills of the Alps. I photographed the house from two points of view, and also took two snapshots of Demoiselle Fabre standing with or near Marchal and Vayssière. I also tried to take the pool and a garden view, but without success—the shade was dense, owing to the almost wild luxuriance of the vegetation. The gravel paths were kept comparatively free but, in passing through, one was brushed on both sides by branches.

I had a very profound feeling all the while that I was an extremely fortunate person to be able to stand where Fabre had stood, to walk upon the ground he had traversed for so many years, to look upon the very cages and apparatus which he used in his ingenious experiments, to see flying about probably the descendants of some of the very bees he had studied, and I fully realized how much such an opportunity would be prized by hundreds of thousands of the readers of his books. I said something of this sort to my companions, and I was rather shocked to find that they did not entirely share my admiration for the great writer. I mentioned Professor Bouvier's

eulogium published in the *Revue générale des Sciences pures et appliquées* in Paris, 1915, and they responded by asking me whether I knew the summary of Fabre's life and works by Ferton, published in the *Revue Scientifique* in September, 1916. I was aware that Fabre's theories had frequently been attacked and that he had made many critics by his pronounced anti-evolutionary views, but I did not know that his accuracy as an observer was subject to serious challenge. But these men told me that, while Fabre ranks among the great in France as a popularizer of science and as a writer of wonderful charm, he has made too many mistakes to be considered a scientific light of unblemished luster.

Since then I have read Ferton's account. Ferton himself died in 1921, in Corsica, where he had lived for the fifteen or more years prior to his death. He was a retired officer of artillery, and for many years has been adjudged the keenest and most careful student of the habits of bees and wasps, and especially of the instincts of these creatures, that France has produced. He was, therefore, entirely competent to criticize a large part of Fabre's work. I have often been asked my estimate of Fabre, but I have never made any studies of the especial insects the lives of which he has immortalized, and I have always been inclined to accept the popular judgment of the man. In fact, aside from Ferton's article, everything that has been written about Fabre since his death has been panegyric. No word of criticism seems to have been uttered. Perhaps this is hardly fair to his numerous readers and admirers. At all events, let us look at him for a moment through the truthful, trained, and thoroughly scientific eyes of Ferton, who states distinctly that Fabre had his weak side and that his published works have shown a trace of this side. He says: "It is our duty to show our great men just as they were. Their fame will not be diminished by this; and Fabre, in spite of his errors,

will remain the great Fabre to whom we owe many beautiful and important discoveries, described in marvelous and enthusiastic language. It is with this thought that I allow myself to make certain criticisms."

By far the greater part of Ferton's long essay is appreciative. He analyzes Fabre's character; he dwells at length upon many of his most interesting researches, and praises to an extreme the charm of his literary style. He charges him, however, with ignorance of, or non-acknowledgment of, the work of others; with carelessness as to the true identity of the species with which he worked; and with faulty observation or incorrect statement concerning one or more of the species that he studied. In each of these charges he brings forward his evidence in a rather conclusive way, but we have no space in this article to give his details. Although praising Fabre's charming literary style, he nevertheless charges him with undue redundancy, and, in at least one instance, with imagining an incident that could never have occurred. He insists that Fabre's bitter complaints about the material difficulties of life and his accusations against society were unjustified, and that he had a comfortable income for very many years, his chronic impecuniosity coming from his indifference to domestic economy.

This, summarily, is the gist of Ferton's criticism, which, however, is not given in this bald way. His review as a whole is highly appreciative and in no way lessens Wheeler's estimate of Fabre as the discoverer of the great significance of animal behavior and of the value of the experimental method in the investigation of the animal mind.

Nowhere have I seen a more just or more enlightened view of Fabre's work than that given by Wheeler in his introduction to *Wasp Studies Afield*, by Philip and Nellie M. Rau, issued by the Princeton University Press in 1918. In Wheeler's opinion, Fabre, Latreille, and Réamur are the three greatest entomol-



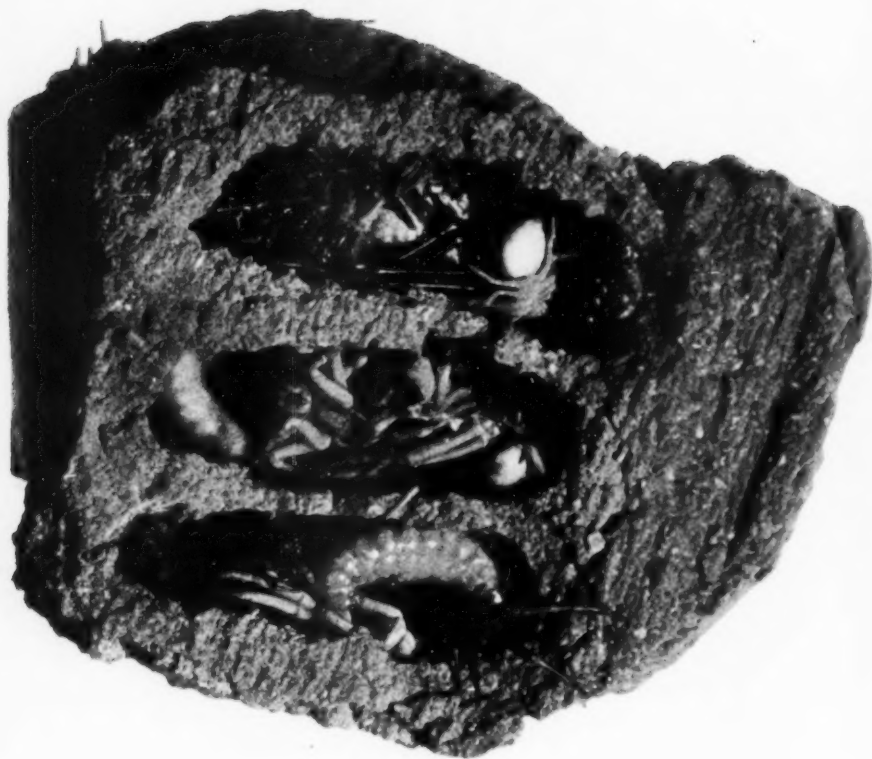
THE FABRE JUBILEE MEDAL STRUCK IN 1910

Obverse and reverse sides

Photographed by J. G. Pratt from the medal in the possession of the author

ogists, and he believes that in Fabre's writings we must acknowledge certain preconceptions which really strengthen their merit and beauty. Wheeler's idea is that Fabre's training as a physicist, chemist, and mathematician made him desire to establish clean-cut laws. In view of this, and because of his scholastic conception of instinct, he insisted on the normal course of behavior in insects; he ignored the variations, and, as a result, "his descriptions and discussions leave an impress of elegance and finality like a

demonstration in mathematics or physics." Wheeler points out also that when *The Origin of Species* was published, Fabre was too old and too set in his ways of thinking to acquire any sympathy with evolutionary theories. Bearing these things in mind, the value of his work is easy to estimate: "He is indeed so preëminent in the wealth and precision of his observations, in the ingenuity of his experimentation, and in literary expression, that his *Souvenirs* will always endure."



Nests of this general character are the unaided production of the female mud dauber wasp, the name commonly applied to two genera of similar habits, *Sceliphron* and *Chalybion*. Each cell of the nest is stocked by the female with captured spiders that she has stung and paralyzed. When the grub emerges from the egg that the parent has laid before sealing up the cell, there is plenty of fresh food available. The cells here shown have been uncovered to reveal the contents. Left to their own devices, the insects would not have issued from these cells until they had reached the adult stage.



A mud dauber wasp, *Sceliphron cementarium*, and her ball of mud, one-fourth inch in diameter. The ball is many times the size of the insect's head, yet she fashions it rapidly, working in muddy or moist ground and having as her tools only her mouth parts, assisted in the later stages by her fore legs

WASPS THAT HUNT SPIDERS

OBSERVATIONS ON *SCELIPHRON* AND *CHALYBION*

BY

WILLIAM M. SAVIN*

ALTHOUGH young bees are fed with nectar and pollen, the larvæ of wasps are given food of grosser character, consisting, according to the provisioning species, of insects of different orders and even spiders. The big *Pepsis* of the Southwest is popularly known as the "tarantula killer," and well does she deserve her name, for she attacks and usually gains the mastery of a creature that man views with dread. Other members of the family Psammocharidæ, to which this wasp belongs, are also spider-destroyers. It might be thought, therefore, that spiders are the preëmpted diet of a single family of wasps, but that is not the case. The wasps described in the article that follows belong not to the Psammocharidæ but to the family Sphecidæ, a family of contrasted dietary habits, for certain other genera of this family provision their nests respectively with crickets, grasshoppers, and caterpillars.

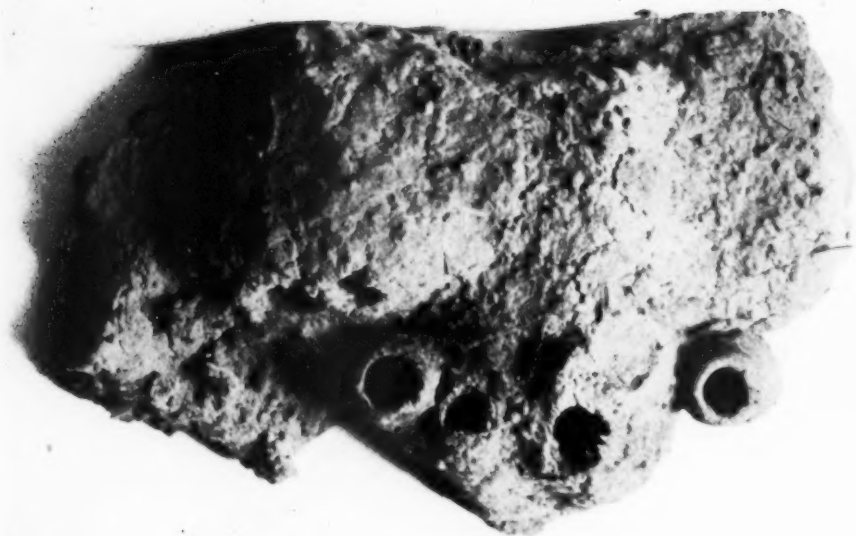
—EDITOR.

AMONG the solitary wasps, of which there are a great many different kinds, the mud daubers, *Sceliphron* and *Chalybion*, seem to me especially interesting subjects for observation. Nests of these wasps have been found plastered "to nails protruding from the walls, on umbrella ribs, corn-husks and other unlikely places," not to mention vines and the root of an over-turned tree. The lower surfaces of flat stones are also used. Before the arrival of man points of attachment supplied by nature must have been employed

exclusively. Today, however, the nests of mud built by these wasps are frequently found in sheltered places about buildings, stocked with spiders which the mother wasp has stung and paralyzed as food for the larva that will later emerge from the egg that she lays.

Both *Sceliphron* and *Chalybion* construct a number of tubular cells in making their nests, which are generally placed in a vertical or horizontal position. The female wasp gathers mud, which she forms into a ball having a diameter of about one-fourth of an inch, though

*Illustrations from photographs by the author



After the wasp larva has devoured its store of spiders, it undergoes a metamorphosis, emerging finally as a winged adult from the dark cell in which it has spent its babyhood and youth. The round holes give indication that the former tenants of the several cells have made their exit



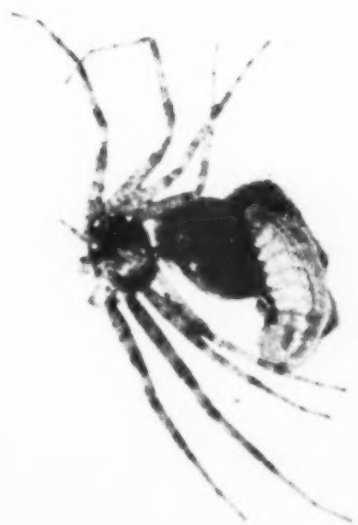
In a nest of this type there are numerous cells, some of which are not visible, being covered by others built subsequently. This nest has been recently finished by the parent wasp. All the cells are sealed, and within them various happenings are taking place. In those last made, eggs are hatching, in others larvæ are devouring spiders, and in still others the insects are undergoing pupation preparatory to becoming adult wasps

sometimes smaller, and with it flies to the nest site, where she applies it to the construction of the cell.

Stocking the cell with spiders is an arduous task and often requires two or more days for its completion. On many occasions after watching the stocking of a cell and then the sealing of it, I have immediately opened it and found a larva on one of the spiders deposited in the early stages of the provisioning—an observation which prompts the conclusion that the wasp had hunted at least two or three days to secure all the spiders, an egg requiring that time to hatch.

Small spiders are used. It would be difficult to carry large spiders to elevated nests, and some of these spiders would not fit the cells, the inside of the cells constituting a Pan's Pipe—the name applied to certain nests of characteristic shape made by these genera—being

not confine themselves to any particular kind of spider, although they capture many more orb weavers than they do other types. They secure also a number of crab spiders (Thomisidæ) and occasionally a jumping spider (Attidæ). I have never found any Lycosidæ, wandering spiders, among the captures of the wasps, which may find difficulty in locating them among the grasses. Although the grass spider (*Agelena naviæ*) is probably the most abundant spider in our fauna and many of them live in



Two mud dauber larvæ, each attached to the abdomen of the spider that serves as food

only about three-eighths of an inch in width. Even cells of smaller diameter are found.

Some spiders are so thoroughly paralyzed by the sting of the wasp at the time of their capture that they die soon afterward, if indeed they are not killed immediately by a too profuse injection of the poison. Others may be seen moving their legs slightly as the cell is opened. Even if they can show these faint evidences of life, however, they are normally doomed captives, entombed as they are in a sealed cell. The wasps do

exposed places, I have never found one in a mud dauber's nest.

The captured spiders are placed in the cell constructed by the wasp, and an egg is laid on one of them, after which the cell is sealed with mud. When the egg hatches, the larva disposes of the spiders in less than a fortnight, pupates, and emerges as an adult wasp.

Although it has been authoritatively stated that the egg is laid on the last spider placed in the cell, I have not found that to be the case in a number of the cells I have opened. As often, the egg



Nine spiders and a mud dauber larva were taken from one cell. Judging from the size of the larva, the cell must have contained originally additional spiders. Among the survivors are crab spiders and orb weavers, one of the latter being a male which may be identified by the bulbs on the pedipalps, leglike appendages near the mouth of the spider. From an examination of the spiders captured by the mud dauber wasps, it would seem that female spiders are more numerous than males—a question which has long been under discussion

had been placed on the first or on one of the first spiders deposited. In certain other instances it was discovered near the middle of the cell. This lack of system may account for the unusual condition of some of the cells: occasionally I have come upon a cell well stocked with spiders but devoid of an egg or emerged larva; in a few instances I have found in a cell two larvæ devouring the spiders, but one of these larvæ may have been that of a parasite.

Now and then the wasp appears to have been forgetful or shiftless, for I have occasionally found a cell without any provisions or larva in it. Another possible explanation is that such empty

cells have been stripped of their provisions by *Sceliphron cementarium* which, according to my observations, at times robs the store gathered by wasps of her own species. On one occasion while watching a *cementarium* that was engaged in putting the finishing touches to her nest plastered on a rafter, I became conscious of another wasp of this species that had a nest on the other side of the board. This wasp went in and out of her cell and wandered several feet from it to inspect the nests of other wasps. After a short time she returned with a spider and deposited it in her nest. My main attention was still directed to the wasp that was closing her nest, and only



The number of spiders placed in a cell is variable. Sometimes the mother fails to gather sufficient food for the growth of her offspring. By way of contrast to such improvidence is the too-abundant provision indicated above, twenty-three spiders all from a single cell! One would judge that the hoard had been gathered for some prospective glutton of the insect world, but after all her efforts in capturing the spiders and packing them into the nest, the careless wasp mother neglected to lay an egg upon them

intermittently to the spider hunter. I was impressed, however, with the fact that the latter had secured a victim so speedily, and secretly commended her as an expert huntress, not suspecting that her capture was not legitimate game. Again she left her nest and in a moment returned with another spider, which, absorbed as I still was in watching the other wasp, I had not seen her secure. At this stage I began to surmise that she had not come by her spiders honestly. When she came out of her cell, I followed her to another nest about ten feet away. From it she brought a spider and carried it to her own. Three times thereafter

she repeated this action and it is a fair inference, therefore, that she stole also the two spiders that I saw her place in her nest first. She soon sealed the cell. When I opened it, I found therein twelve spiders, four of which had certainly been stolen, two probably, and the remaining six possibly. An egg had been deposited on one of the early spiders placed in the cell.

On another occasion I was watching a *Sceliphron cementarium* that had made but one cell for her nest and was ready to stock it. For a time she wandered to and fro, then went to a nest near by, entered it, and brought out a spider,

which she placed in her own cell. She again visited the nest she had robbed, but although there were other spiders available, she did not repeat her theft.

The owner of the despoiled nest returned shortly, entered her cell for a moment, and on coming out examined the exterior of the nest for several minutes. This wasp brought no spider on this visit. The cells of both nests were sealed up a little later, the mishap possibly hastening the action of the wasp that was robbed, for her nest was not fully stocked. Neither was that of the thief, however, for this wasp showed herself indolent as well as depraved. On opening her nest I found in it only one spider, a small female banded epeira (*Metargiope trifasciata*) with an egg on it. This scanty supply of food could not have enabled the emerging larva to survive long. That the egg was in all probability laid by the thief and had not been transferred by her from the other nest when she removed the spider is attested by the fact that in the despoiled nest an egg was found on one of the five spiders placed therein.

On several occasions I have experimented with the larvæ to test their efforts at self-preservation, and the instance described below is typical. Due to the character of the cells the larva is always in close touch with the food supply, which it can obtain with a minimum of effort. It was of interest to me to ascertain whether it would go in search of food more remotely placed. Upon seeing a *Chalybion cæruleum* seal a Pan's Pipe, I accordingly secured the nest and opened it. There were four compartments in a row, each cell being stocked with spiders. In one of the cells was an egg, which had been laid on the last

spider deposited, in another a small larva, and in each of the remaining two a larva about half grown. I placed the three larvæ, each still attached to the spider on which it was feeding, in a large dish and then some inches away, in the same dish, the untouched spiders from the three cells in which these larvæ were found. The dish was then covered with a newspaper so as to exclude the air. The smallest of the larvæ lived only a couple of days, nor did other small larvæ which I used subsequently in similar experiments survive longer. One of the two large larvæ after completely consuming the spider on which it was feeding, worked its way across the dish to the heap of spiders and proceeded to devour one. The other large larva sucked only the juices from the abdomen of its spider, whereupon, leaving the enveloping skin of the abdomen as well as the untouched cephalothorax and legs, it too worked its way over to the large supply of spiders, which were apparently more inviting. Twice after that I placed the spiders at the opposite edge of the dish and in each instance the larvæ wriggled to them. The supply of spiders was increased through the addition thereto of those contained in the cell in which an egg was found. A larva had emerged from this egg after from two to three days but it had survived for only forty-eight hours. The additional spiders were, however, superfluous. In about a week the larvæ had eaten all the food they craved. They then floundered about, apparently looking for a place to pupate. I placed a small paper tube near them but neither larva used it, and in about another week both died.



Cretaceous bad lands on the north fork of Sand Creek, Red Deer River, Alberta. An incomplete skeleton of *Palaeoscincus* and other fine specimens were obtained from this locality by the American Museum expedition of 1915

A SUPER-DREADNAUGHT OF THE ANIMAL WORLD

THE ARMORED DINOSAUR PALÆOSCINCUS

BY

W. D. MATTHEW*

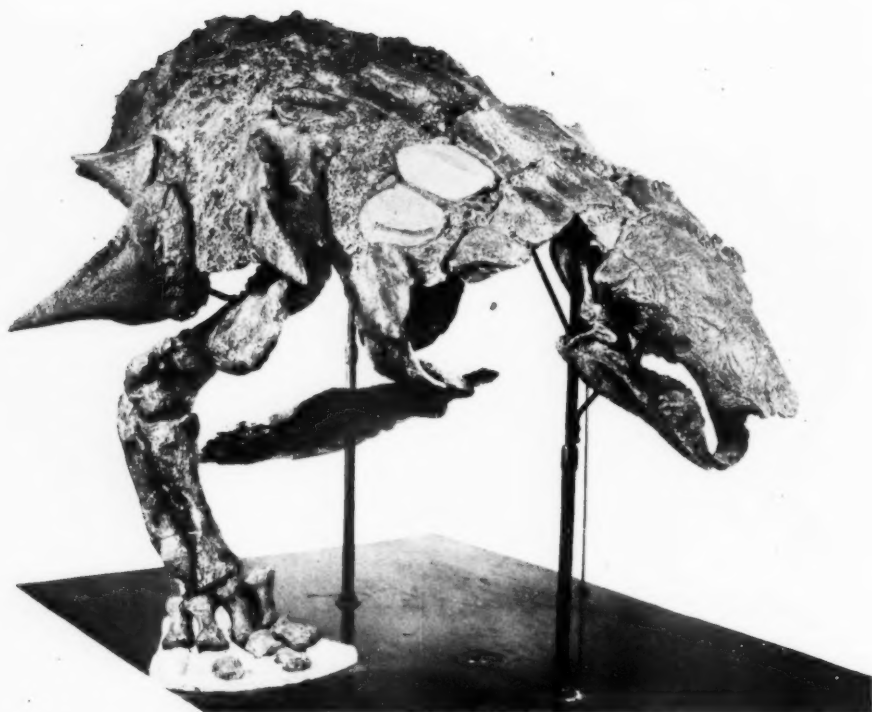
SIXTY-SIX years ago Professor Leidy, of Philadelphia, described an odd-looking fossil tooth that had been brought back by the explorer-geologist, Ferdinand V. Hayden, from the bad lands of central Montana. Leidy named it *Palaeoscincus* because it resembled the tooth of a small modern lizard known as the skink. Probably very few people outside of professional zoölogists have ever heard of the skink.¹ It lives in the Mediterranean region but there is nothing especially interesting about it, except that it was used in medieval times as an ingredient of some of the horrible messes that physicians of those days used to concoct and administer to their unfortunate patients. That, however, is by the way.

Scincus officinalis.

Doctor Leidy suspected that the *Palaeoscincus* was a dinosaur rather than a lizard, as the tooth was of the same general type as in the *Iguanodon*.² In those days, however, they did not know much about dinosaurs and it was not possible to be sure of the real affinities of the animal. *Palaeoscincus* remained in the limbo of doubtful and half-forgotten names until recent years. There is much that we don't know about dinosaurs even now, as will appear before the close of this article; but a great deal has been ascertained in the course of the last twenty or thirty years, chiefly owing to the explorations and researches of half a dozen leading American museums, and

¹*Iguanodon* and *Megalosaurus* were two gigantic extinct reptiles which Mantell described about a century ago from the Wealden formation of England and which were so remarkable and different from any living reptiles that Owen proposed the name Dinosauria for them.

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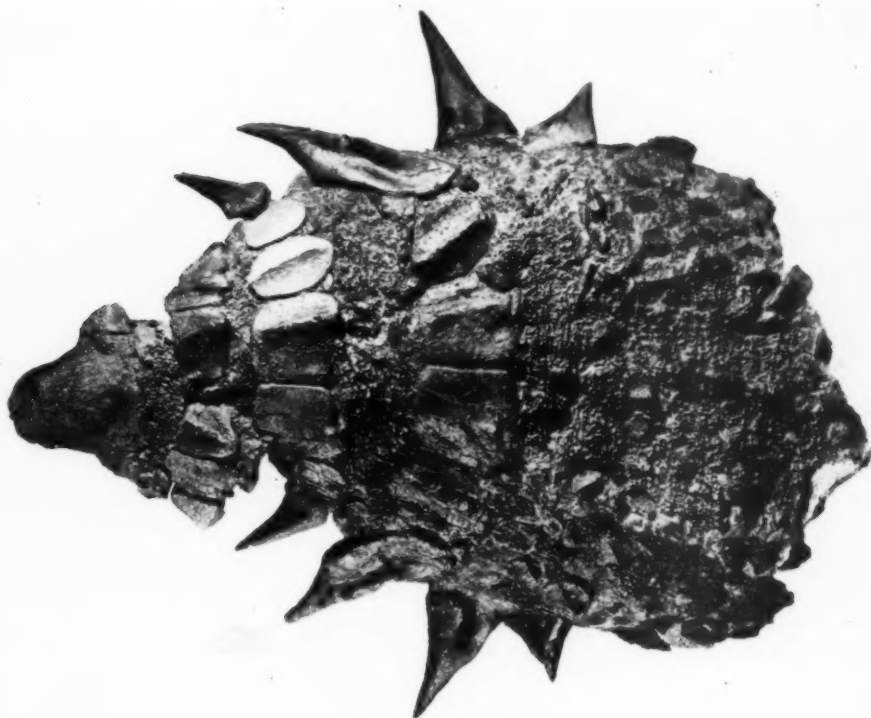


The broad, flat head and wide body, with great spines along the sides, seen in this front view of the *Palaeoscincus*, suggest a gigantic and exaggerated "horned toad." The limbs are very stout and massive, to carry the great weight of the animal

among many other interesting discoveries is that of the kind of animal that Leidy's *Palaeoscincus* really was.

In 1915 Mr. Barnum Brown, associate curator of fossil reptiles in the American Museum, obtained a magnificent collection of dinosaur skeletons from the Red Deer River in Alberta. Several of them belonged to the group of great armored dinosaurs which he had described from Montana in 1908 under the name of *Ankylosauridae*. When he studied and compared these Alberta skeletons, he found two kinds, one of which appeared to be the *Ankylosaurus*, while the other had teeth identical with the *Palaeoscincus* which Leidy had described more than half a century before. We had found out at last what the *Palaeoscincus* was like and a most extraordinary beast he was, as we shall see.

The capstone to the discovery was provided by Mr. Levi Sternberg, who, while hunting dinosaurs in the Alberta fossil field with his father, the veteran fossil-hunter, C. H. Sternberg, discovered an armored dinosaur specimen that had the armor all preserved in place, covering the fore part of the skeleton. It was indeed pretty badly preserved, distorted and collapsed under the pressure of the hundreds of feet of sediment that had been piled on top of it in subsequent geologic ages, the upper surface flattened and crushed down into the under side, one fore limb crushed under the body, the other missing; while the entire hinder half of the body and tail had been destroyed by erosion when the Red Deer River cut its great cañon through the heart of the Alberta plains and thereby brought to light the long-buried skele-



Protected by thick plates and massive spines, this great armored dinosaur, the top view of which is shown in the picture, must have been a veritable super-dreadnaught of the animal world. Observe the rows of large plates in the neck region and fore part of the trunk

tons of their ancient fauna. However, the specimen offered possibilities of finding out what this armored dinosaur was like and especially how the great armor plates were arranged on the body. Generally the great plates and spines associated with the fossil skeletons of armored dinosaurs are found so jumbled and heaped together that their emplacement during life is mostly guesswork.

On Mr. Brown's recommendation this specimen was purchased for the American Museum and the work of preparation and mounting entrusted to Messrs. Otto Falkenbach and Charles Lang. The task proved very difficult and tedious. The true skin, anatomically speaking, was not preserved but only the impressions of it and the innumerable little nodules of bone imbedded in it. In the skin were set at intervals, in more or less regular arrangement, the larger

flat plates and spines. The bone was mostly soft and brittle, crumbling, at times almost pulverulent, and buried in a sandstone matrix which, while not hard, was much harder and firmer than the bone and exceedingly difficult to dislodge without damaging the delicate surface. As each little bit of the surface was exposed, it was necessary to strengthen it by repeated soaking with shellac and other hardening fluids, and the work of preparation extended over months. By dint of the utmost skill and patience the fore-limb bones were dissected out and most of the bones and skin of the under side were separated, so far as they could be recognized. Then bit by bit, the flattened and distorted upper surface, with the backbone and ribs attached beneath it, was restored to its natural curvature and mounted on a steel framework, the bones of the under side set in

position and the surviving fore limb articulated and mounted.

The total time spent on this specimen was 223 days, most of it consumed in the cleaning of the surfaces and in dissecting apart those that were crushed together. Such expenditure of time can be justified only by exceptional scientific or exhibition value in the specimen. We knew beforehand that the *Palæoscincus* would provide important and very much-needed evidence as to the arrangement of the plates and spines in this group of armored dinosaurs. It has turned out a much better exhibition specimen than we had expected, and for this the skill and ingenuity of the preparators are chiefly responsible.

As finally prepared and mounted the specimen shows very well the outward form and proportions of this great armored reptile as far back as the middle of the body. No attempt has been made to reconstruct the missing parts, except for a few small areas near the border where the skin has been restored between the bony plates, chiefly to hold them in position. Otherwise the rows of plates and spines and the intervening skin, studded with small, bony nodules but evidently flexible during life, are restored to their natural relations by the exact fitting of breaks in the bone caused by crushing and by the resetting of displaced spines or plates that were obviously paired with others still in position, or clearly belonged in series with them as proved by characteristic peculiarities of modeling.

It would have been far easier for these skilled preparators, expert in all that pertains to plaster work and modeling, to restore the armor and skin of the animal, setting the big plates and spines by guesswork in some more or less plausible arrangement that would probably have been not very different from the actual structure, and to give to the specimen so finished an appearance that even an expert could hardly have detected that it was "faked." But that is not done at

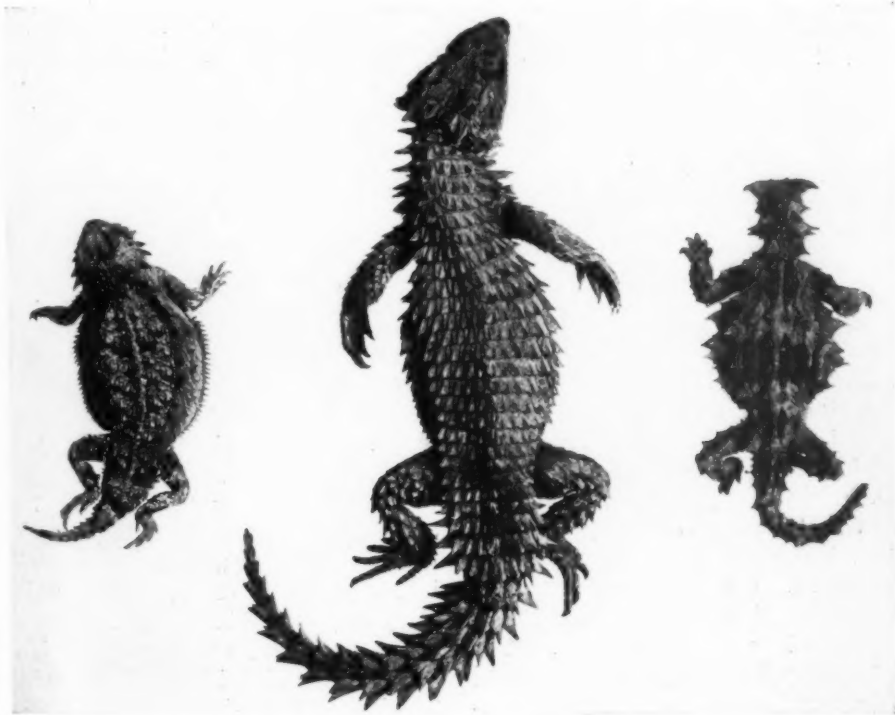
the American Museum. It is wholly against the principles of that institution, one of the objects of which is to recover and preserve the evidence upon which scientific knowledge of these extinct animals is based. The more important and interesting specimens are placed on exhibition, and in many cases it is advisable to restore or outline missing parts; but care is always taken to indicate clearly what parts are restored, and to state on the labels the evidence (usually other skeletons of the same or nearly related species) upon which such restored parts are based. The standards of the Museum are exacting in this respect and are loyally lived up to by the staff, who well understand that the reputation of the Museum and the real and solid progress of science depend upon the strict observance of such standards.

The *Palæoscincus* was a huge armored reptile with a broad, short body, massive legs, thick, heavy tail, and a small, flat-topped, triangular skull. The proportions of the hinder parts are known from other skeletons found by Mr. Brown in Alberta, but the exact arrangement of the armor of the hind quarters and tail is not yet known. Undoubtedly, as in other nearly related armored dinosaurs, there was a series of rings covering the root of the tail and heavy plates enclosing the tip. Probably also the great spines and plates that belong upon the hind quarters were arranged in a series corresponding to those of the fore quarters, as they are in various other animals of more or less similar type, especially in some of the modern spiny lizards. The "horned lizard" (*Phrynosoma*) of the western states, commonly known as the "horned toad," the "spiny lizard" of Africa, *Zonurus*, and the "Moloch lizard" of Australia, are not unlike the *Palæoscincus*, although of diminutive size by comparison. The arrangement of the spines and plates of *Palæoscincus* is a combination of the wide, flat, laterally projecting spines of the short-bodied

"horned lizard," the serried rings of the "spiny lizard," and the irregular armor of the "Moloch lizard." The arrangement of the armor on the hind quarters and tail probably corresponded in a similar way to that of these three modern analogues.

Palæoscincus, however, has longer and much stouter legs in proportion to the body than modern lizards, and in this,

have the legs greatly reduced or altogether absent, and wriggle along the ground like snakes. The dinosaurs in this respect are like the mammalian quadrupeds, which spend a large part of their time on their feet, with the body carried clear of the ground, and are capable of prolonged walking or running for long distances without interruption. The legs of the *Palæoscincus* are stout



Three modern lizards which, save in their diminutive size, are suggestive of the *Palæoscincus* of the Cretaceous Period. The "horned toad" to the left is nearest in proportions. The "spiny lizard" in the center and the "Moloch lizard" to the right also have some points of resemblance. The figures are about two-thirds natural size. Were the little modern lizards as large as a hippopotamus, they would be monsters almost as strange as the long-extinct armored dinosaurs

among other characters, shows its dinosaur relationship. For the dinosaurs, although so different from one another in proportions, have all of them comparatively well-developed limbs, while nearly all modern lizards and crocodiles have small and slender legs that carry the weight of the body only for short dashes, the animals resting upon the ground between whiles. Many lizards

but unusually short for a dinosaur and the feet rounded and compact, with short toes and small, flattened hoofs. A rhinoceros has longer limbs but not so massive, as he has less weight to carry.

The skeleton of *Palæoscincus* bears throughout the marks of slow and very limited movement; even the modern tortoises are agile by comparison. Yet the animal must have obtained food ade-

quate to nourish his giant carcass and only an abundance of succulent vegetation would seem to provide a supply sufficient to sustain so huge a creature. We know from the study of the rock formation in which the remains are found and from the associated plant and animal remains, that he lived in what was then a great delta plain, watered by rivers coming from higher land to the eastward, a low and swampy region with an abundant vegetation, some of which is still preserved in the great coal fields of Alberta. The region enjoyed a warm climate, as shown by the palms, figs, plantains, and other tropical trees preserved as fossils. An animal of the type of *Palæoscincus* would not be well suited to aquatic life and the feet are not well adapted to marshy ground; so that we may suppose that he kept to the drier parts and sandy stretches along the streams to avoid being mired in soft ground.

The short, small head is like that of a tortoise in having a broad, rounded, horny beak used to nip off vegetation; and for chewing the food thus secured *Palæoscincus* had, in addition to the small and rather useless teeth, a couple of stout, horny plates on the upper and lower jaws. Like the tortoise he was well protected against carnivorous enemies, but in a different manner. The tortoise, small or of moderate size, must case himself wholly in armor and withdraw head, limbs, and tail behind an armored barrier. His enemy may then drag him around and turn him over and over, but can find no chink in which a tooth or claw can be inserted.

The *Palæoscincus* was differently proportioned. His tail was too large and massive to be drawn within the body armor. Hence, it had to be cased in rings of bone, overlapping and somewhat flexible so as to preserve some freedom of movement, and was especially protected at the vulnerable tip by very heavy plates. His head, a massive block of bone, had bony sheaths to cover the eyes,

nostrils, and the sides of the jaws; the horny beak needed no protection. The broad neck was protected by rows of large, thick, flat plates arranged in rings that afforded no purchase for the jaws or claws of his enemies, the great carnivorous dinosaurs. The back was covered with similar flat plates, less regularly arranged, and the sides of the animal with stout spines, some of them a foot or more in length. The limbs could probably be drawn under the body and required no especial protection; but at the shoulders and probably at the hips, large spines projected outward and forward to cover a possible point of attack. Too massive and heavy to lift, too broad and flat to roll over, his sides and under parts thoroughly protected or out of reach when he squatted down upon the ground, the *Palæoscincus* must have been invulnerable or nearly so, even to such huge and powerful enemies as the carnivorous dinosaurs whose fossil skeletons are found associated with his in the bad lands of the Red Deer River. What formidable enemies these must have been one may judge from the three skeletons mounted in the hall of dinosaurs, American Museum—one of them in a running pose, a second standing, the third in the position in which it lay when found in the rock. No such giant carnivores, nor any approaching them in size, inhabit the earth today. The largest lions, tigers, or bears are far smaller, and if the *Palæoscincus* lived at present, he would have no need of such huge and massive armor for defense.

Why, then, did the animal not survive? Was it that, in spite of his massive and elaborate defense, the great carnivorous dinosaurs found some weak spot, or that his armor was inadequate against the attack of the still huger *Tyrannosaurus* that appeared upon the scene a little later in geologic history? Or was it that, although the adult was so armed as to be practically immune from attack, nature could not, or did not, provide an adequate defense for the eggs, presup-



RESTORATION OF THE PALEOSCINCUS

A huge and slow-moving reptile with massive armor, designed for protection against the gigantic carnivorous dinosaurs. Restoration by E. M. Fulda, 1921

posing that eggs were laid, and for the young? We know nothing at all about the development of the young of *Palæoscincus* nor, for that matter, of any other dinosaur. We do not even know whether dinosaurs laid eggs. Most reptiles do but some are viviparous. A few fragmentary remains of half-grown dinosaurs have been found, but on the whole the rarity of young animals is very remarkable. They may have lived in some different habitat from the adults—perhaps in the uplands or away from the streams and marshes, so that their remains are not preserved. Whatever the cause, we know nothing of them and can only speculate as to their enemies being a factor in causing the extinction of the group.

Professor Cope once suggested, more or less humorously, that the little, opossum-like mammals found in the same formations as the huge dinosaurs were in the habit of sucking the eggs of these giant reptiles, and that their depredations finally brought about the extinction of the group. A more probable suggestion, advanced by Professor Henry Fairfield Osborn, is that epidemic diseases transmitted by insect pests may have caused the extinction of many of the large animals of former times, just as the cattle pest and other epidemics have swept away so much of the modern large game of Africa. These and other causes are possible or probable factors in the extinction of the Mesozoic animals, but there is no way at present of finding out whether they really did play an important part.

There are, however, certain conditions that assuredly did exist and that may have caused the disappearance of the *Palæoscincus* and other giant reptiles. One of these is the appearance of the mammals—animals which even at that stage of their development were of much higher intelligence than the dinosaurs, so far as we can judge from the brain casts of the different types. Dinosaurs had brains of small size compared with

their huge bodily proportions, and of low type, indicating an intelligence scarcely as high as that of a modern crocodile or lizard. The mammals of the beginning of the Tertiary period had brains that were inferior to those of any modern mammals, of lower type even than those of the marsupials, but still of much higher grade than any reptilian brain. Their teeth and other organs for seizing and devouring their prey or digesting vegetable food were also in various respects better and more adaptable, and they had other points of superiority. Nevertheless, it is scarcely possible to perceive any way in which those earliest mammals could have come into competition with the dinosaurs that we are acquainted with. So far as we know, the early mammals at the end of the Age of Reptiles were all small creatures of such different habits and adaptations that they could not have come into any direct competition for food and pasture with the giant dinosaurs or in any serious degree have interfered with their welfare.

In a very indirect way indeed, the superiority of the mammals may have been a principal cause of the fall of the reptilian dynasty, but for the more direct reason for the extinction of the great dinosaurs of the Upper Cretaceous we must look to other causes. This much is clear, that they were gigantic and highly specialized animals, adapted to certain special modes of life and a particular environment, requiring on account of their great size a very large amount of food, and therefore liable to perish wholesale if this food should become scarce or the environment change and become no longer suitable. A smaller and less specialized animal could alter his habits and food to fit the changed environment, and might well survive where the giant dinosaurs would become extinct.

Moreover, all modern reptiles, owing to their comparatively slow and imperfect blood circulation, are cold-blooded.

That is to say, their body temperature varies with the temperature of their surroundings and they are not able to maintain a consistently high, uniform temperature of the body in the face of much colder surroundings. They grow torpid in the cold and are quite unable to maintain an active life, and must either find refuge in caves and deep burrows or perish. This appears to be an incurable defect in the reptile, as his scaly or horny skin allows the heat of the body to escape readily. Mammals and birds, on the other hand, are covered by a non-conducting coat of fur or feathers that enables them to retain the heat of the body, and has allowed them to build up a much more active and perfected system of blood circulation. This in turn is fundamental to more active habits of life, higher brain development, and other points of superiority. If this difference in the character of the skin-covering be the underlying reason for the limitations of the existing races of reptiles, it is certain that the dinosaurs were similarly handicapped, as they had the same general type of scaly or horny covering. The modern reptiles are quite unable to maintain an active life in the northern winter and, in consequence, are chiefly found in tropical or warm temperate regions, those which do range farther enduring the winter only by retiring to caves or burrows and hibernating there.

At the time that the giant dinosaurs flourished a warm climate extended over all the temperate and even Arctic regions, if we may judge from the tropical flora associated with them. It was also a time when vast swamps and deltas and heavily forested lowlands stretched over a great part of the land areas, in contrast to the great plateaus, mountain ranges, and arid or desert interiors that characterize our modern continents. Toward the end of the Age of Reptiles a great progressive change was going on, certainly in the physical geography and apparently in the climate as well. Its

early stages are shown in the slow rising of great parts of the flooded continental interior above sea level, turning them into delta and coastal swamp and then into plains and upland, while great stretches of the ancient land were more violently uplifted into high mountain ranges, whence the rivers brought ever-increasing floods of sand and mud to spread over the plains and marshes and build out deltas far into the shallow seas, burying the old lagoons and flood plains of the Cretaceous under great thicknesses of sediment, filling up and drying out the swamps and changing the environment in which the dinosaurs lived. More important probably was the change of climate which seems to have been going on at the same time that these geological changes were taking place. While on the one hand we find in the Cretaceous formations as far north as Greenland a fossil flora of warm-temperate type, on the other we find the evidences at the beginning of the Age of Mammals of glaciers existing as far south as southern Colorado. The evidence is very scattered and fragmentary, and scientific opinions vary a good deal as to just how it should be interpreted, but it would seem that a great change in climate must have been in progress at that time, from moist, subtropical, and warm-temperate conditions prevailing over all the world, to climatic contrasts much more like those that exist today. Such changes would necessarily sweep away the ancient swamps and forests and alter the entire character of the vegetation almost everywhere. The dinosaurs, highly specialized and adapted to the old conditions, unable to withstand the cold and too bulky to seek refuge in caves or burrows, would disappear and become wholly extinct.

The dinosaurs were the last survivors of the various groups of giant reptiles that dominated the life of the Mesozoic Period, or Age of Reptiles. The great sea reptiles—ichthyosaurs, plesiosaurs, and marine crocodiles,—the mosasaurs that

lived in the shallow seas, and the pterodactyls that flew above them, had already become extinct. With the closing of this last scene of the Age of Reptiles the scenery is shifted, the background is changed, and the stage is cleared and set for the next great act in the drama of geologic history, the Age of Mammals, with the evolution of modern quadrupeds and of birds as its keynote.

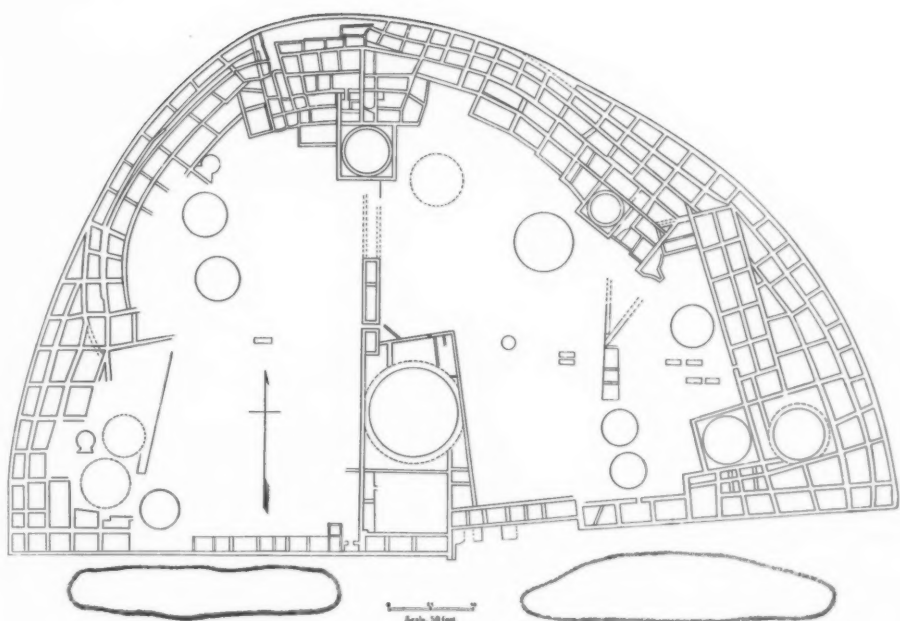
The direction of evolutionary progress in the dominant types of life has changed. In the Age of Reptiles, at least in its later phases, the struggle for life, the competition between the different reptilian types, is concentrated on the development of offensive and defensive weapons of gigantic size and elaborate armature. It culminates in the huge *Tyrannosaurus* with its terrible teeth and claws, in the great *Palæoscincus* with its massive armor of plates and spines. In the Age of Mammals, on the other hand, the emphasis of evolutionary progress is shifted to the development of agility and speed, of adaptability to changing conditions of life, of a higher type of brain, the last feature foreshad-

owing the final act, the keynote of which is to be the dominance of intelligent life in man.

I have always found it somewhat difficult, and perhaps others may as well, to conceive of the Age of Reptiles and the extraordinary and nightmarish creatures that then populated the earth, as other than a fantastic dream. They are such strange and unexpected combinations, such caricatures and exaggerations of existing types of animals, that even with the help of mounted skeletons or modeled restorations it is hard to conceive of them as other than the creations of fancy. I have spoken of them as the actors in a great epic drama, a representation of the History of Life on Earth, and so indeed it is easiest to picture them. Yet they did once exist, not merely upon the stage, but in real life. They are no creations of fancy. And this *Palæoscincus*, now on exhibition at the American Museum, showing before our eyes the veritable outward form and garments of one of the strangest of these strange extinct reptiles, may go far to help us realize that they are not creatures of the imagination.



Miniature models of the armored dinosaur, by Charles Lang and Otto Falkenbach. Slight differences in the two models, especially in the tail region, show the varying opinions of experts when restoring the missing parts from other specimens



Ground plan of Pueblo Bonito. Prepared by Mr. B. T. B. Hyde from the general ground plan of the pueblo made by Mr. N. C. Nelson and from the field notes and room plans of Mr. George H. Pepper

PUEBLO BONITO AS MADE KNOWN BY THE HYDE EXPEDITION

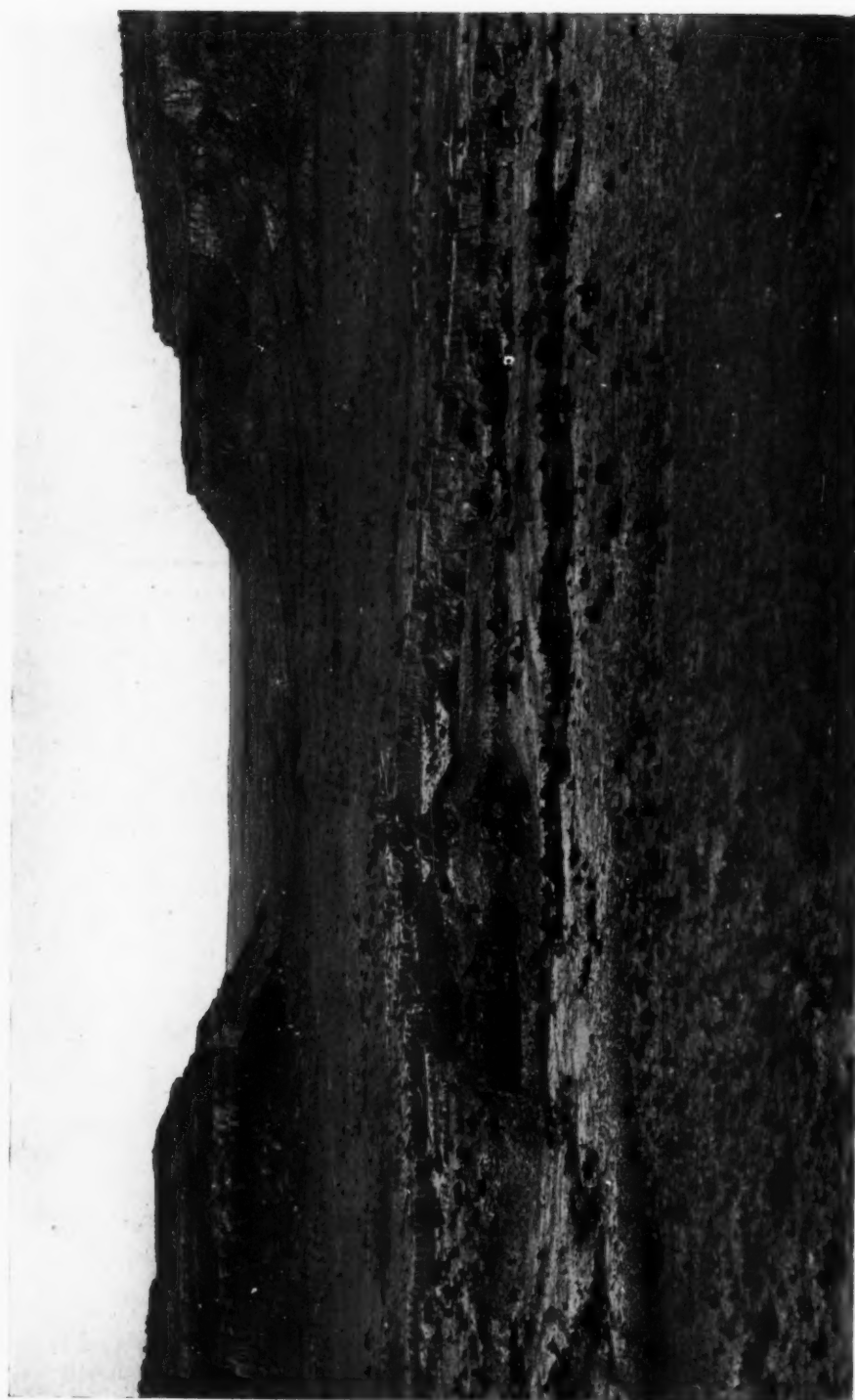
BY
CLARK WISSLER*

ONE usually thinks of a cañon as a deep, narrow cleft in rock, through which flows a wild, boisterous river. But in the arid stretches of New Mexico and Arizona one often meets with dead cañons, as it were, through which, in ages long past, real rivers did flow but which are today streamless. One of the best known of these is in northwestern New Mexico and is named Chaco Cañon. The mighty river that once plowed out this great trench in the sandstone has disappeared, although an occasional rainstorm may start a sorry, halting stream that soon sinks out of sight into the sand.

The main cañon is about twenty miles long and varies in width from three-quarters of a mile to a few hundred feet. The side walls are for the most part

steep, sometimes rising to a height of 125 feet. Imagine the lower Hudson flanked on either side by palisades, its stream run dry, and the winds whirling the white sands about in its bed,—the resulting picture will be not unlike Chaco Cañon. The chief interest in the Chaco, however, lies not in the cañon itself, but in the magnificent ruins it contains. For there was a time, long before the white man came, when a people lived down in this cañon. That in their day these cañon dwellers were far from commonplace is attested by the ruins left behind, among which are some of the most remarkable to be found within the whole United States. Of the large ruins there are twelve, and among these is the now famous Pueblo Bonito, a building of huge proportions and in a fair state of pre-

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A VIEW ACROSS CHACO CAÑON

In the middle foreground is Pueblo del Arroyo, so named because of the ancient stream bed that winds past it. The wide opening in the background is known as the Gap

In the middle foreground is Pueblo del Arroyo, so named because of the ancient stream bed that winds past it. The wide opening in the background is known as the Gap

5.1.1



PUEBLO BONITO VIEWED FROM THE NORTH

The standing semicircular back wall is clearly seen on the left of the picture. At about the center of the highest part a wall of later construction was spliced or joined to the older masonry, thus increasing largely the number of outside rooms. The line of cleavage of the old wall and the new is clearly shown on p. 350. The large refuse heaps can be seen along the front of the ruin and numerous excavated rooms in the foreground



Some of the important excavations made by the Hyde Expedition are indicated in this picture

servation. This ruin, which first came to notice in the writings of Josiah Gregg in 1844, was described in some detail by Lieut. J. H. Simpson in 1849, and again by William H. Jackson in 1878. It may be of interest to quote from the description of Lieutenant Simpson.

"Two or three hundred yards down the cañon, we met another old pueblo in ruins, called Pueblo Bonito The circuit of its walls is about thirteen hundred feet. Its present elevation shows that it has had at least four stories of apartments. The number of rooms on the ground floor at present discernible is one hundred and thirty-nine. In this enumeration, however, are not included the apartments which are not distinguishable in the east portion of the pueblo and which would probably swell the number to about two hundred. There, then, having been at least four

stories of rooms, and supposing the horizontal depth of the edifice to have been uniform from bottom to top, or, in other words, not of a retreating terrace form on the court side, it is not unreasonable to infer that the original number of rooms was as many as eight hundred. But, as the latter supposition (as will be shown presently) is probably the most tenable, there must be a reduction from this number of one range of rooms for every story after the first; and this would lessen the number to six hundred and forty-one. The number of *estuffas* [kivas] is four—the largest being sixty feet in diameter, showing two stories in height, and having a present depth of twelve feet. All these *estuffas* are, as in the case of the others I have seen, cylindrical in shape, and nicely walled up with thin tabular stone. Among the ruins are several rooms in a very good state of preservation—one of them (near



Interesting objects, including ceremonial sticks and pottery, were unearthed in this section

the northwest corner of the north range) being walled up with alternate beds of large and small stones, the regularity of the combination producing a very pleasing effect. The ceiling of this room is also more tasteful than any we have seen—the transverse beams being smaller and more numerous, and the longitudinal pieces which rest upon them only about an inch in diameter, and beautifully regular. These latter have somewhat the appearance of barked willow. The room has a doorway at each end and one at the side, each of them leading into adjacent apartments. The light is let in by a window, two feet by eight inches, on the north side. There was among the ruins another room, which, on account of the lateness of the hour and the consequent despatch of our examination, escaped our scrutiny.”

The report of Jackson in 1878 added

little of importance to the subject, and so the great ruin remained until the several publications alluded to came to the notice of Frederick Ward Putnam, the distinguished anthropologist at Harvard. From a study of these reports Professor Putnam saw reason to believe that Bonito and the Chaco Cañon held the key to the story of the Southwest. Putnam was a born teacher and a leader of men, so it is not strange that two of his students, Messrs. B. Talbot B. Hyde and Frederick E. Hyde, Jr., were fired with the zeal of the master. It so happened that the Hyde brothers made the acquaintance of Richard Wetherill, a resident of the Southwest already famous as the discoverer of the cliff dwellings of that region. Wetherill had long known the Chaco and its ruins and was keen to see Bonito uncovered.

When the Hyde brothers laid the project before Professor Putnam, they found him a more than sympathetic listener. Just previous to this, Professor Putnam had been appointed curator of anthropology in the American Museum. Thus, in short, it came about that the Hyde brothers financed an expedition to the Chaco, now widely known as the Hyde Expedition.

During the years 1896-99 extensive excavations were made in the ruin under the immediate direction of George H. Pepper, formerly assistant curator in the American Museum. A large part of the ruin was uncovered and some of the most beautiful types of pottery and work in turquoise yet found in the United States were discovered. These remarkable objects have long been familiar to visitors to the Museum.

The number of rooms on the ground floor, as revealed by the excavations of the Hyde Expedition, is 268. Owing to the tumble-down nature of the upper walls, it was found impossible to determine the exact number of rooms; but, as estimated, they exceeded six hundred, or approximately the count of Lieutenant Simpson. However, the latter failed to note the large number of kivas, observing but four, whereas the excavations of the Hyde Expedition revealed eighteen, and doubtless still more will come to light with future excavations. Yet Lieutenant Simpson is not to be blamed for this error. Not being familiar with this type of Pueblo architecture, he naturally failed to note the fainter traces of buried kivas. When we consider the obstacles

encountered by Lieutenant Simpson in his initial survey, necessarily made without the help of excavations, the clearing away of fallen logs and of drifted sand, the accuracy of his observations is truly remarkable.

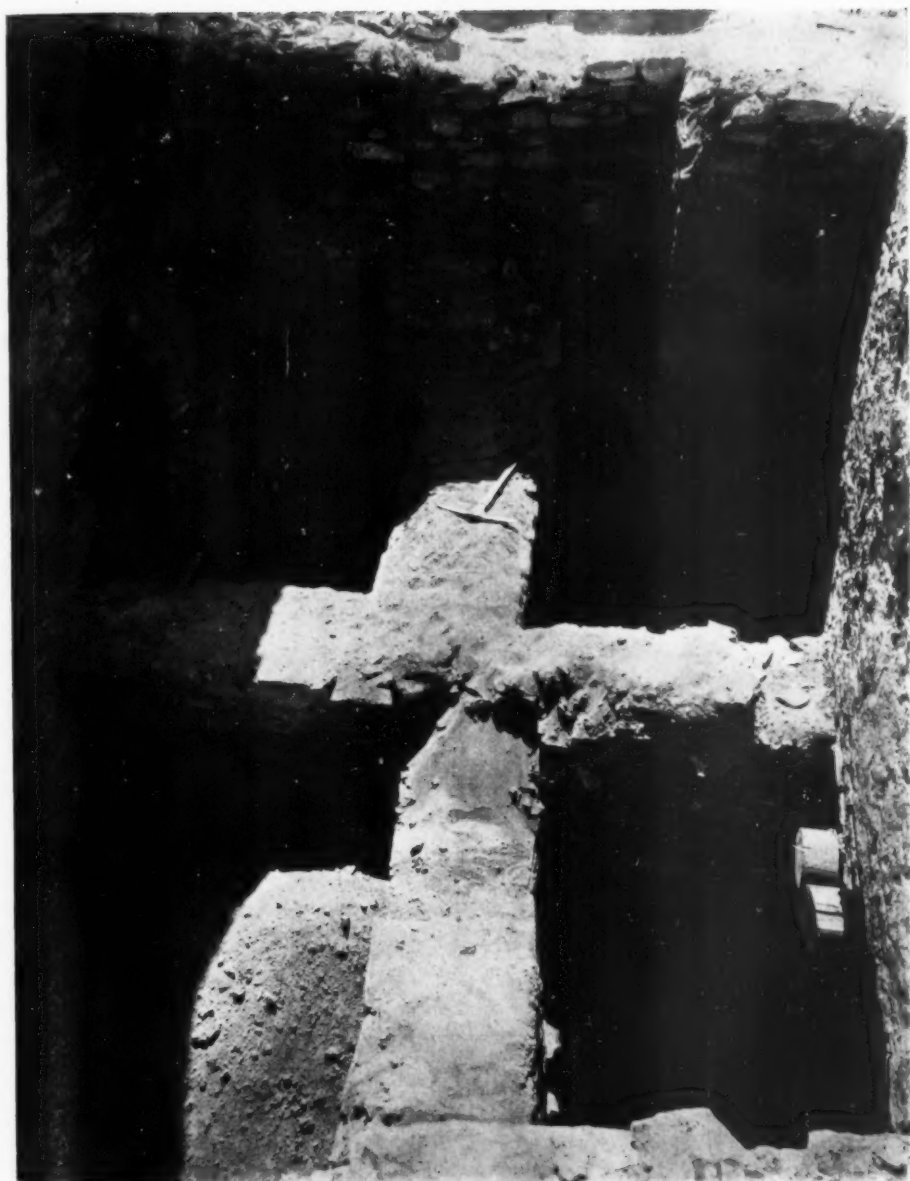
Since 1899 the Hyde brothers have not found it possible to continue exploration in the cañon, so Mr. Pepper has prepared a full report of his work at Bonito, which has recently been issued by the Museum as Volume 27 of its *Anthropological Papers*. It consists of 398 pages, with 167 illustrations, 8 of which are in color.

Interest is now added to this publication by the resumption of excavations at Bonito by the National Geographic Society and the United States National Museum. At the hands of these institutions Bonito is to be entirely uncovered, the walls repaired and the whole maintained as a National Monument for the enjoyment and mental stimulation of all who travel in the Southwest. We are thus assured that the important work initiated by the Hyde brothers, at great personal sacrifice, will be carried through to completion, and that this ruin, one of the grandest of prehistoric time to be found in America, will be thoroughly known and properly appreciated.

To the Hyde brothers belongs also the credit of the first serious attempt at intensive archaeological work in the Southwest. It was the results of this work in particular that directed the attention of scientific men to the problems of the Southwest and may therefore be considered the first step, as it were, to that end.



Flageolets ornamented with animal figures carved in relief. The figure on the upper instrument is, according to Frank Hamilton Cushing, that of a bear. The carving on the lower flageolet represents, in the estimation of Mr. George H. Pepper, a mountain lion.



EXCAVATED ROOMS

More than once when an apparently solid floor had been reached in the course of excavation, further digging brought to light additional chambers beneath; these were of various forms and shapes and often of a different architecture from the walls above



Here can be distinctly seen the line of junction of the original outer eastern wall of Bonito with the new outer wall that was built at a later period in the history of the pueblo



This type of kiva, or ceremonial chamber, is characterized by the low, benchlike platform around the wall. The openings in the wall above the platform supported the beams carrying the superstructure. In these beams are usually found in cuplike depressions small offerings made by the builders



This small circular room, quite different from any other in the ruin, was floored with worn-out and useless metates which had been inverted and placed about a circular stone



It is possible that this room was set aside for the preparing of meal for ceremonial purposes, the metates, which show great wear, being used to this end



A ceiling, the top layer of which consists of cedar splints placed at right angles to the layer of cottonwood poles below. Notice also the smoothed surface of the stones on two of the fragmentary walls



It must have been an arduous labor to split out, trim, and smooth the boards used in the floor of this room. As was often the case, the weight of the debris from above had broken the supporting beams



These fragments of pottery were subsequently pieced together and their ensemble forms a brown-ware jar of rare interest. The lower, bowl-shaped portion of the vessel is smooth and the upper half carries a deeply incised design



The stone mortar with the balanced, interlocked design in red and white covering the outer surface is a unique example of decorative art. It is the most elaborately ornamented object of this nature that was found in the pueblo



An unusual discovery in Bonito was a hoard of cylindrical jars, a special form of pottery not found elsewhere



Under the floor of this room was uncovered pottery and basket ware buried in circular holes or pits. Later builders in the pueblo did not know of them and constructed a wall over one of the pits



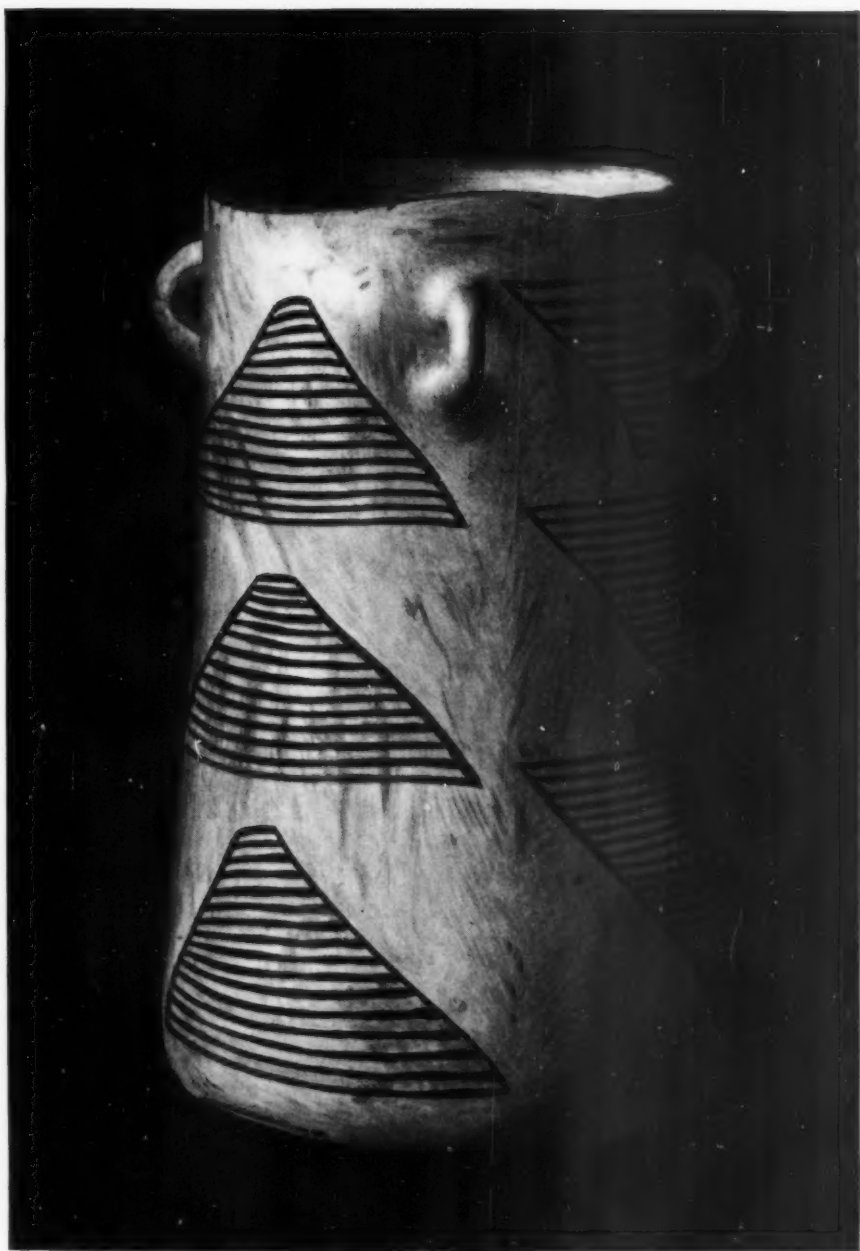
A CHARACTERISTIC JAR FROM BONITO

A unique type of pottery was found in Bonito by the Hyde Expedition. One hundred and fifty or more cylindrical jars were found cached in three rooms with a care that suggests their use in some sacred ceremony. No such pottery has been found elsewhere, with one exception. At the Aztec Ruin, about sixty-five miles to the northwest, Mr. Earl H. Morris found the broken parts of vessels of the same form and decoration.



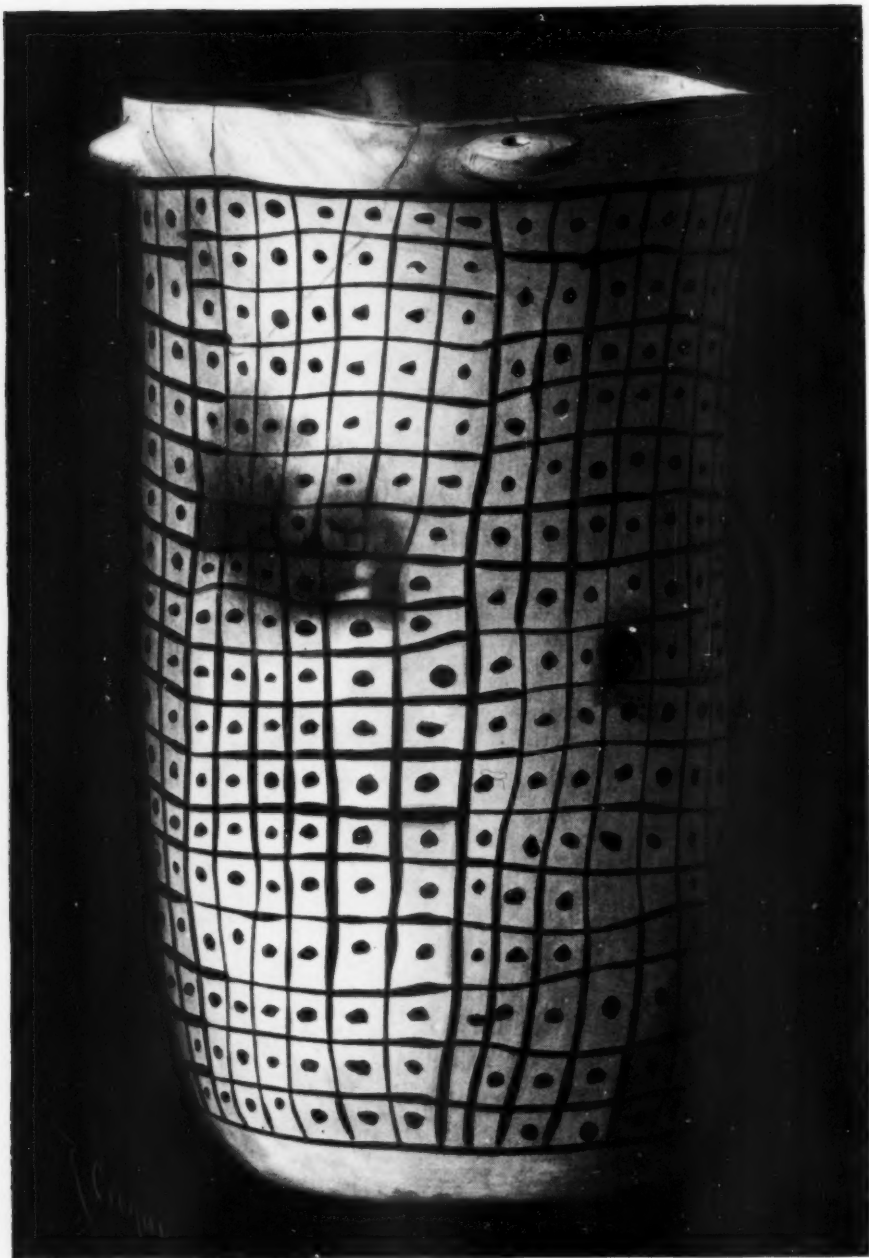
BLACK-ON-WHITE WARE

One type of pottery made by the builders of Bonito is known as black-on-white. In the making of such pottery, the vessel was covered with a white slip upon which the designs were painted in black. The specimen represented is a good example of this type of Pueblo pottery, the artist, R. Cronau, having given a faithful copy of the colors



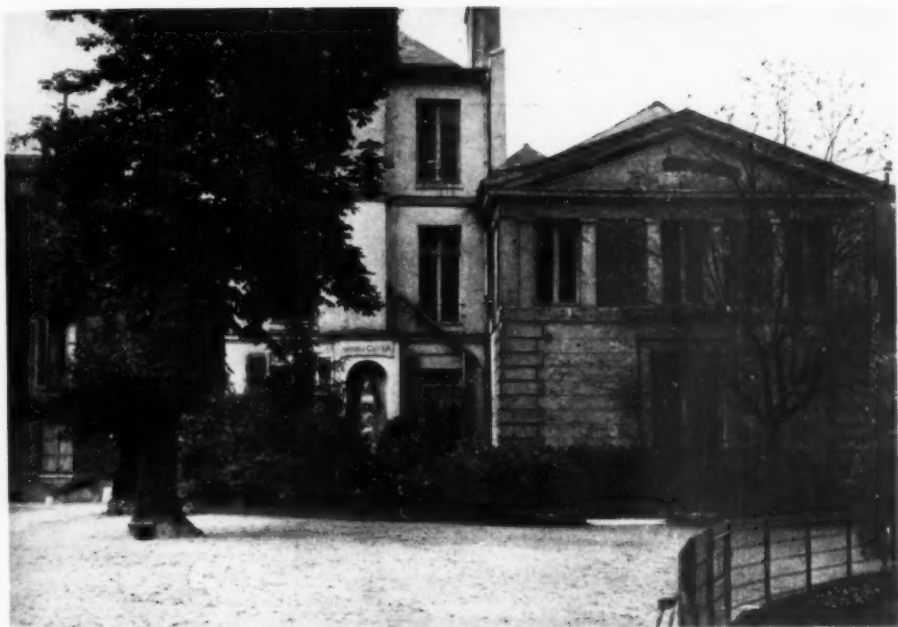
JAR WITH VERTICAL HANDLES

In a single cache of 114 of these cylindrical jars, 66 were found bearing ornamentation. The variation in handles is also interesting. The jars ranged from those entirely without handles to jars with three and four handles, the greater number having four. It has been suggested that these handles may have been intended for the attachment of feathers



JAR WITH DESIGN SUGGESTING EAR OF CORN

It is always difficult to know what was in the potter's mind when such designs as the above were projected. In this case, however, we can be reasonably sure that an ear of corn is intended. Special ears of corn play an important part in the religious festivals of modern Pueblo Indians, and there is every reason to believe that such were held sacred by the builders of Bonito. We infer also that special sacred ears of corn were set up on end as parts of altar decorations. Curiously enough these cylindrical jars have the shape and size of the small basketry stands used by modern Pueblo Indians for holding sacred ears of corn. One may hazard a guess, therefore, that this jar and its design represent such a sacred ear

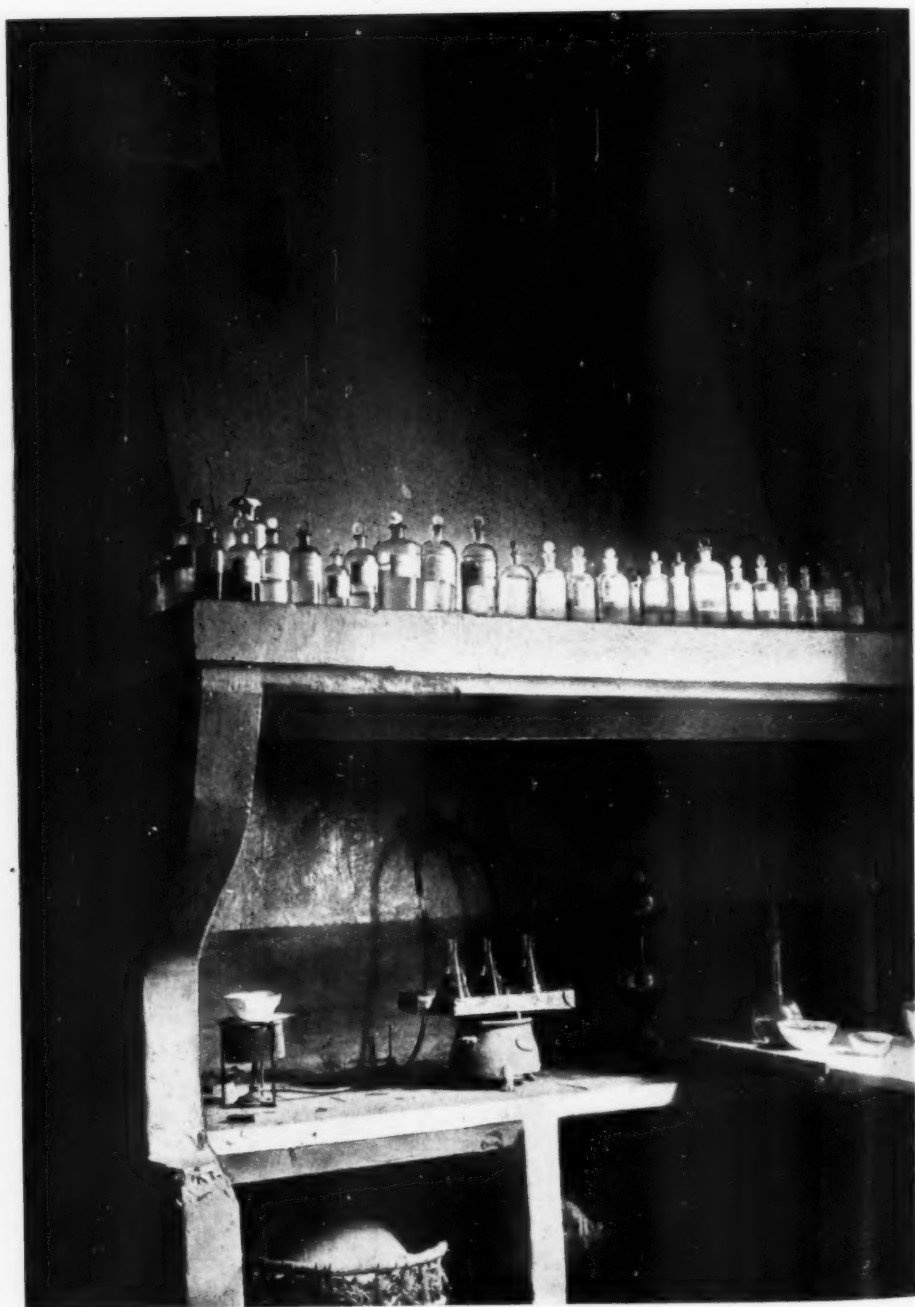


Exterior view of the building in the Jardin des Plantes where Georges Cuvier lived and worked. Note the bust of the great naturalist with the inscription "Maison de Cuvier"

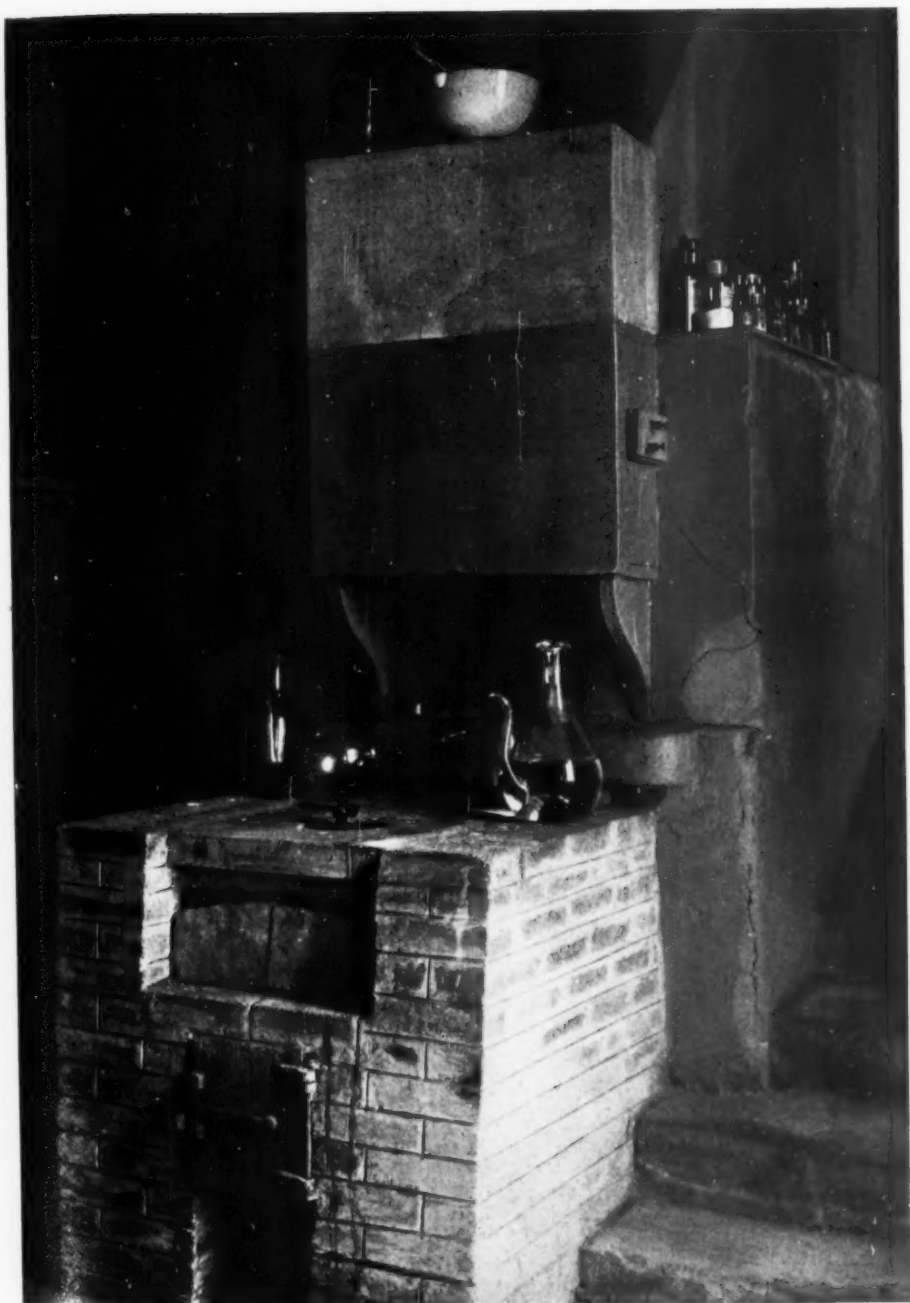
THE HOUSE OF CUVIER

IN THE Jardin des Plantes in Paris stands a charming old-world building, La Maison de Cuvier, at one time the official residence of Baron Georges Cuvier and still full of mementos of its distinguished occupant. It was in this building that one of the greatest scientists of all times, a man who put the impress of his genius on three important branches of human endeavor—systematic zoölogy, comparative anatomy, and palæontology—was domiciled during the tenure of his professorship at the Jardin des Plantes. Cuvier's connection with the garden dates from 1795, when, through the influence of Lacépède, Lamarck, and others, he was appointed assistant to Mertrud, the professor of comparative anatomy. In 1802 he succeeded his superior as professor of that science and laid the foundations of the collection of comparative anatomy that is still one of the great intellectual attractions of the site.

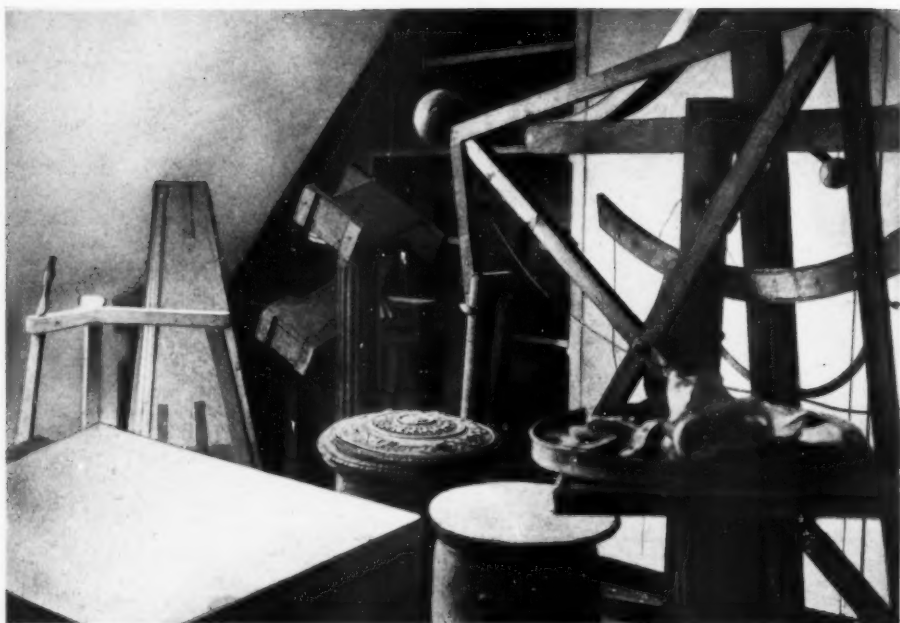
The Jardin des Plantes is a fitting environment with which to associate the memory of so genuinely devoted a scientist as Cuvier. Founded in the first half of the seventeenth century by Guy de la Brosse, physician to Louis XIII, it was originally nothing more than a Jardin des Herbes Médicinales. In 1793 the museum of natural history was established within its bounds, and today its spacious acres along the banks of the Seine are occupied not only by nursery gardens and greenhouses but also by a well-stocked menagerie, various museum galleries devoted to anatomy, anthropology, botany, geology, mineralogy, and zoölogy, laboratories, a splendidly equipped library, and a lecture hall, where courses are conducted by the most eminent men in all branches of natural science. For the quaint and charming illustrations that follow, *NATURAL HISTORY* is indebted to Monsieur V. Forbin, of Paris,



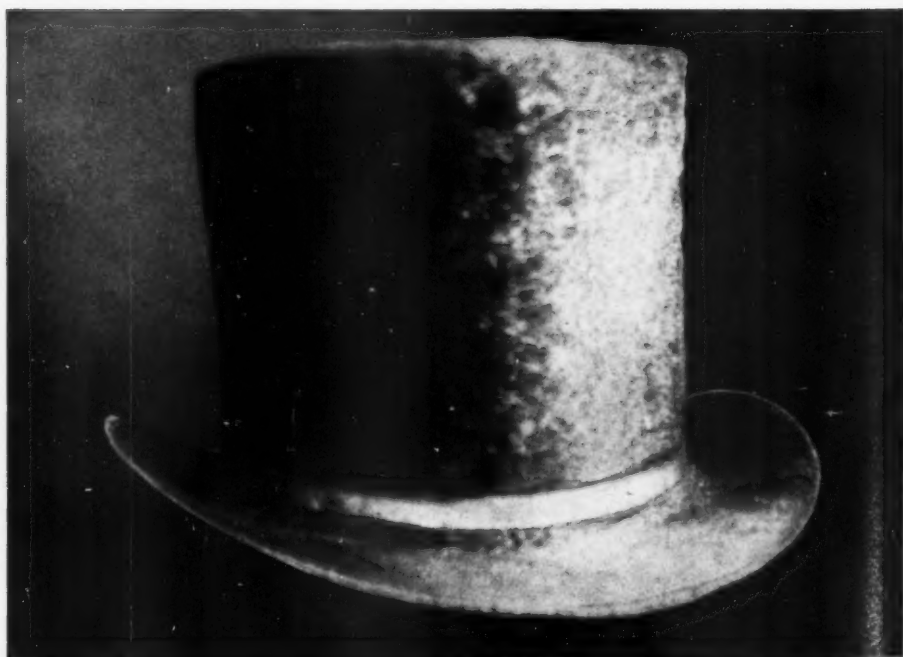
CUVIER'S LABORATORY



THE FURNACE (OR FOUR) USED BY CUVIER



The garret of the house with several instruments used by Cuvier

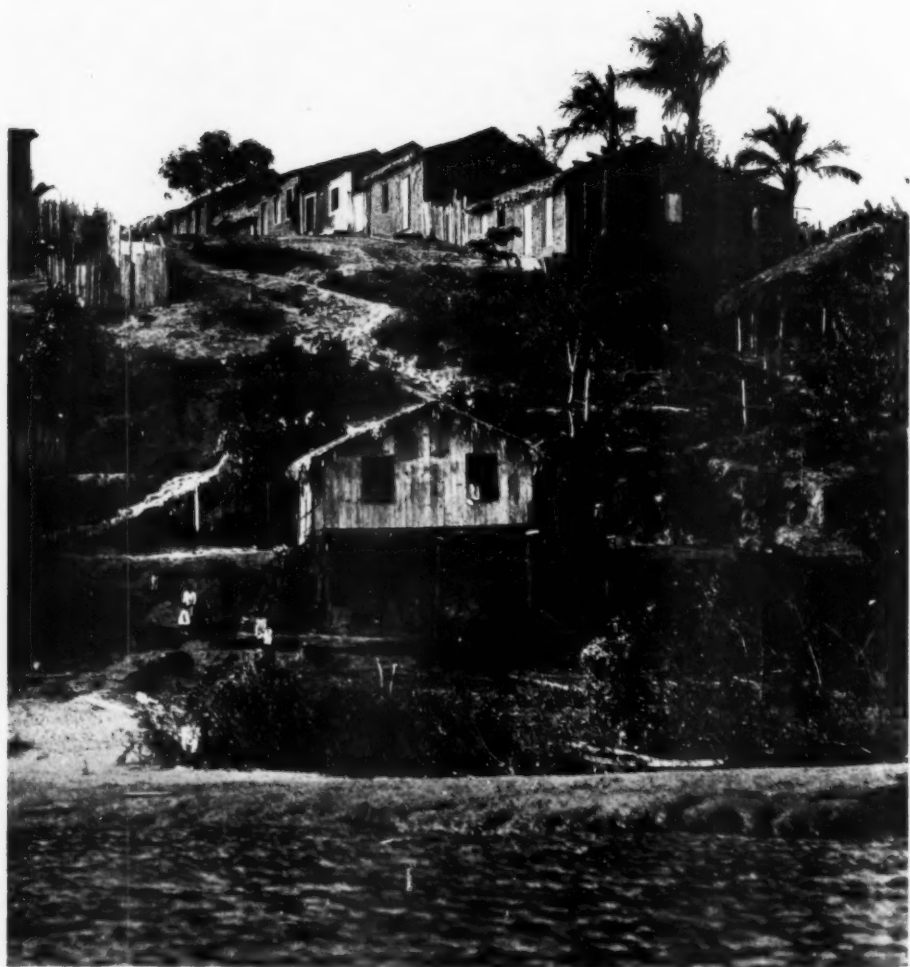


Cuvier's hat, on exhibition in the Salle Historique of the Paris Museum



THE FAMOUS LEBANON CEDAR IN THE JARDIN DES PLANTES

Legend has it that Bernard de Jussieu brought the young plant in his hat and shared his water ration with it during the long journey



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ONE OF THE LARGER SETTLEMENTS JUST ABOVE MANAOS

It is built along the hillside out of reach of the rising river. The production of Brazil nuts, rubber, turtle oil, and tobacco gives the people a livelihood

AMONG THE CABOCLOS OF THE RIO NEGRO

BY

WILLIAM J. LAVARRE

THE Rio Negro, which flows into the yellow Amazon some nine hundred miles from the Atlantic, and stretches back its tortuous, forked branches across Venezuela and into the high Andes of Colombia, is the pathway of a little-known clan. These copper-skinned people, whose lineage is of Portuguese, Spanish, and Negro, fused with many tribes of jungle Indians, are born wanderers. They speak Portuguese, Spanish, and *Lingua Geral*, the tongue commonly understood by all the tribes of the Amazon basin. When they are tiny, pot-bellied infants, their voyaging begins; they are jumbled quite gleefully into a crowded canoe, or a *batelao*, with flea-bitten pups, parrots, and monkeys for companions. Later in life they think, as their ancestors did, that it is just as easy and expedient to float placidly over those black waters as it would be to establish themselves permanently in any particular hut upon the lonely shore. The whole of the forest bordering both sides of the river and the many forested islands belong to everyone and to no one, and the Caboclos, as they are called, may roam where they like and squat whenever they have a mind to.

As I was journeying up the meandering Negro not so long ago, I passed settlement after settlement that seemed deserted. High grasses had sprung up, and the dark, convoluted jungle was creeping in on all sides, bent on reclaiming what had been snatched from it temporarily by human beings who had soon grown weary of the sedentary life. In most cases the only reminders of human existence were rough crosses, which marked the places of the dead that were left behind. In the jungle a village in which death has occurred is regarded as hoo-dooed, and frequently the inhabitants move out of it in great haste. Once, as we glided along close to the shore, a

lonely, grunting pig came complainingly down to the water's edge, sniffed, and squealed at us, and at another place a red-plumed cock, with featherless neck, lazily flapped his wings and crowed complete ownership of the abandoned domain. I do not know why even those two living remnants survived unless it was that the pig was too heavy to be carried in the already overladen canoe, or that both the pig and the cock had run into the forest and hidden, reappearing only after the inhabitants had left.

"Where have the people gone?" repeated the uncompassionate Portuguese gentleman who had waxed rich by his industrious operations in rubber, Brazil nuts, and piassaba fiber. "Bah! They go like they come . . . nowhere! *Bichos! Vagabundos!* All the time they go, go, go. They say they go for rubber, to *festas*, because someone has died, but it is all the same; if there were no rubber trees, no celebrations, no deaths, they would go anyway. . . . *Bichos! Vagabundos!*"

When a Portuguese says "*Bicho!*" it is equivalent to our exclaiming "Worm!" I needed nothing more to recognize the feeling of the Portuguese for these folk. He, like all the successful men on the Rio Negro—and they are so few that I could name them on the fingers of two hands—considered the wandering, happy-go-lucky Caboclos as little more than animals, poorest of the poor. They are, as the Portuguese gentleman declared, vagabonds, and they are poor, but I for one wish to speak of their many good, if simple, characteristics. Personally I like them; perhaps there is a certain kindred feeling born of the *Wanderlust*. I have been among them, sharing their already too small huts, eating the same meager food, and listening to them as they talked among themselves, telling charmingly imaginative tales of adven-



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A floating Caboclo household on its way down the river with a load of rubber. In such crafts these people like to spend their life, drifting here and there over the tortuous stretches of the rivers, meeting new people, going to *festas*, looking for ease. They are rolling stones that gather no moss

ture or gossiping about their little happinesses or tribulations.

This is the way my acquaintanceship with them began. I had been beseeching the god of adventure to come my way when, suddenly, one morning, several years ago, I found myself sprawling in the hot sun, nearly a thousand miles from civilization, as represented officially by Manaus, at the mouth of the Negro. A feeling of loneliness came over me as I saw the little American flag which flapped so airily from the stern of the departing launch, on which up to then I had been cruising, fade in the distance. I got out my pistol, loaded it, and stuck it in my belt. Then I sat down on a damp log, fanning insect devils, to await the advent of the first mortal, be it wild man or tame, or coy Amazon. On the Rio Negro I had seen small craft that floated lazily on the current, but they were invariably so filled with people, rubber, foodstuffs, pieces of smoked meat that resembled so many chunks of charcoal, tame birds, chattering monkeys, babies, and what not besides, that the thought that one more thing could be

conveyed in them never entered my mind. Such a floating Caboclo household on its way to take up existence at a new location was usually mildly humorous and amazing. Everything would be there save the grass hut, which they could easily fashion if they did not choose to take up their residence at some deserted spot whereon a dilapidated shelter already stood. But even those overladen canoes were not plentiful, and I was not hopeful of coming upon one speedily. However, the unexpected happened, for presently I heard, faintly at first and then louder, the swish, swish, swish of paddles as they cut into water. I hid behind a rock; for I wanted to have a chance to see the occupants of the boat before they saw me.

A moment later I saw a canoe laden with the piled-up possessions of a Caboclo family come from behind the bend and float toward me, and I stepped out of my hiding place. The occupants of the canoe naturally rubbed their eyes upon beholding the lone *Americano*. I fancy that if I should walk into a room some evening and find a naked savage

standing before the fireplace, I, too, should be startled. That is not to say that I looked savage or ferocious. I am firmly convinced that at that particular moment I was about as forlorn and affable a creature as could be found anywhere. I raised my voice and yelled at them. When their canoe touched the bank, they began questioning me. I told them the necessary details; enough, at any rate, to assure them that I had not, as they suggested, fallen like a bad angel from the skies. They looked at each other and conversed in low whispers. "*Muito mal!*" the old man of the party exclaimed at last. Yes, I agreed heartily, it *was* very bad. Could they give me a lift? The old man looked at the almost submerged boat and then at me. "*Caramba, Senhor*, but if we place a cobweb more on this *canoa* she sinks!" They looked at me and shook their heads. "It is not possible!" From the pile of humanity and supplies I separated two old men, two young men, two old, toothless women, a bland-faced girl and several (I could not disentangle them exactly) babies. Again I mentally agreed with what the old man had said. They certainly could not have carried me.

The venerable spokesman began lisping like a knight of old Castile, "We are bound for our *sítio*. We will go there quickly and then in the empty boat some of us will return for the *Senhor*. Will that be all right?" "How far is your home?" I asked. "A little way," he answered. I had to smile and be content. "All right," I announced, "I'll be waiting here." Without another word or a nod they pushed off and were soon lost to view behind the lower bend.

Through the long hours of the day I sat watching the green and red lizards that scooted across the ground holding their long tails high in the air. Macaw-parrots flew through the azure sky, and small, gay birds played hide-and-seek with each other in the scrubby bushes along the water's edge. I gasped with pure delight when a scintillating spot of

almost ethereal blue came fluttering from the gloomy, wall-like foliage behind me, like some spirit from another world—a gorgeous, blue butterfly of that species which has led so many enthusiasts into ill-fated adventures. I recalled old Johnstone, distributor of Bibles to the heathen, naturalist, and explorer, with his horribly twisted mouth (moonstruck, he said) who had chased such a butterfly into the coils of a giant boa constrictor. I sat still as the butterfly hovered above my head and then started suddenly away toward the forest, pausing in turn for a moment and then returning to hover a second time close to my head, as though it were trying to entice me to give chase. "No you don't, you beauty!" I protested. "You are exquisite; you are enticing but you're a siren!" As though it understood what I had said, it alighted on my knee and, seeing I made no attempt to clutch it, edged over to my wrist and then on to my fingers. The beauty of the design and the blending of those different hues of blue were marvelous, and I breathed carefully lest I disturb my woodland visitor. It pulsed a moment longer on the tip of my thumb, aglint like an iridescent gem, and then, floating tantalizingly away into the dense forest, was lost.

Just as I was thinking of improvising a shelter from the twilight storm that lurked in the eastern heavens and of lighting the proverbial fire which keeps wild animals away, I heard renewed swishings and made out the form of a canoe approaching from downstream. "*Senhor Americano*, are you there?" a voice called, and I stood up and greeted my rescuers. When they had run the bow of the boat upon the shore, the three paddlers helped me with my small duffle-bag and large metal jars of pickled snakes and other reptiles which I had been collecting. When I explained to the natives that the jars contained reptiles, the men laughed; they wanted to know what good they were—was I going to eat them?



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A somewhat elaborate native home with thatched roof and adobe sides. The natives love waving palm trees and cultivate them whenever they can



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The father of this family secretly wished to marry off his two daughters because, as he confided to the author, women are too expensive. "They always want you to buy them gaudy cloth that fades and vaseline that loses its smell"

We journeyed down the stream in the darkening evening, cooled by a rising breath of air. No sound disturbed our going save the dismal cry of a night bird, the continual swish, swish, swish of the paddles, and the gentle lapping of the wavelets against the boat.

"What will the *Senhor* do?" they asked me.

"I want," I confided to them, "to get down to Sao Isabel where I can board the little steamer that goes monthly to Manaus— Can I?"

I heard a giggle in the darkness. . . .

"Can the *Senhor* swim?"

But I felt in no mean mood. Having been saved from a lonely and hungry night, I was suffering rather from a reactionary spell of joviality. I could swim, I assured them, but my snakes could not, and I vowed I wouldn't go a step, or a stroke, without my snakes. They were going with me to the Museo Americano! That struck them as very funny and they laughed a good while. Maybe it was. I think of it now as only an idiosyncrasy of the moment; sometimes, you know, a drowning man will clutch his treasures though they weigh him down.

A little before midnight a flickering red glow became visible on the shore on the right, and from it a slender reflection gleamed out over the water like a jagged javelin of shimmering fire. We turned toward it and soon ran the bow of our canoe upon a low stretch of sandy beach. Upon the higher bank a small fire burned, and moving carefully toward it over the uneven ground, I found a shadowy, palm-thatched hut fronted by a deep, cool portico. Within one of the two rooms burned a rag wick protruding from the apex of a small conical tin of oil which had been placed on a tiny shelf that jutted out from the smooth wall of patted white clay. In the uneven light I was able to make out only the dim forms of several people swaying in net hammocks. We did not disturb them. I swung the hammock which my host

had given me across the cooler portico, and my rescuers went within after bidding me a soft "*Boas noites, Senhor.*"

When I opened my eyes the next morning, I found a cup of coffee held out toward me by a smiling, bare-legged maiden. I smiled back sleepily at her, whereupon she fled, leaving the cup in my hands. The liquid was black and thick, and had been sweetened by the



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Joaquin da Silva, a halfbreed, penniless rubber gatherer, but the most human, charitable being I have ever met. He is prepared to go on a collecting tour. Note the small-headed hatchet for gashing trees, the gourd bucket, and the leaf-cups. Everything he uses he gets from the forest, or makes himself

juice of sugar cane. I drank it greedily after a period of sniffing and sampling, vowing, as I still do, that no coffee, however much it may be petted and coerced by white-capped chefs and nickel- or copper-plated percolators, has ever been so delicious.

My new friends and I became ac-



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(On the left) A rubber tree of the forest into which an incision has been made. The white latex is dripping into the leaf-cup attached at the lower point of the trough. The white gashes are the oozing milk

(On the right) Close view of the milk as it drips from the banding trough into the improvised leaf container where it collects until the native gathers it into his larger gourd. One hundred trees give a gallon of milk, which, when smoked, yields two kilos of rubber, for which the native collector receives about two dollars

quainted in a surprisingly short time. They told me that they had come from a little settlement up in Venezuela to spend a few months at their Brazilian home, where they had many wild rubber trees, the milk of which was already beginning to flow. The rubber-collecting season was setting in, and they said that in a few more days the river people would be exchanging habitations, each family going into sections where they had been accustomed to gather rubber and smoke it, or taking up new homes in areas on which they had discovered fresh trees. I thought probably that was the explanation of most of their wanderings. But it was not that entirely; there was much more to their roaming than the discovery of new trees. During the afternoon a canoe paused to exchange greetings. It was loaded, as customary, to the brim,

and the stockily built man at the stern declared they were going to visit some friends on the lower river. They were carrying their household with them as they did not know when they might return. He might never return, he hinted, for he had heard that it was much pleasanter and easier to live on the lower reaches of the river—"Life will be sweeter there." They were in haste to be on their way, but they graciously agreed to wait until I wrote a letter to Senhor F—, an acquaintance who lived below the rapids, requesting him to come for me in his launch.

The natives, I believe, considered me as a novelty. I was a revelation to them just as they were to me. They sought to please and humor me in every way. I followed them over the small, hidden trails through the dark forest while they



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Forming hardened rubber around a pole over a dense acid smoke. Each layer of fresh milk hardens when it comes in contact with the smoke, increasing the size of the ball. This has all the properties of gutta-percha. The natives fashion bags, shoes, and other articles from it by hand

hunted or collected the thick, white milk from the wild borracha trees. At their hut I watched them smoke this liquid into large, dirty-looking balls, and even became expert in the operation myself.

Most of the articles about the home were made by hand from the products of the forest: the utensils were earthenware or gourds; nails were made by sharpening pieces of brittle palm mid-rib; fiber from the leaf of the tucum palm was twisted or braided into very strong cord (stronger than the silken fishing line I carried with me from the States). My hosts dressed, except at celebration times, in thin calico and often in rags, and ate farina cakes and what game and fish they were able to kill. But what there was they shared with me gladly and even attempted to give me more than my portion, or to deny themselves entirely, say-

ing they did not like certain things which they saw I was very fond of.

Days merged into weeks. Gradually people crept up the river or drifted down it. Smoke was visible every afternoon, oozing up in thin, curling wisps from the forested shore, marking the spots where half-naked men squatted around a smoking flue and added layer after layer of white milk to a ball of rubber formed round the center of a short revolving pole. Two gaudily painted *batelaos* came, bringing *caxasa*, calico, and knickknacks, to be traded for rubber. One of them brought a note from Senhor F— announcing that as soon as he could arrange his affairs he would come for me.

With the arrival of *caxasa* on board the traders' *batelaos* there followed many gay periods of idleness and celebrations. *Caxasa* is a watery-looking liquid, made



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I think of the hospitality of the Caboclos as the greatest in the world. This native hut was given over to a party of explorers. The natives went down to the sandy beach to spend the night there



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Young girls returning from a local plantation with their canoe loaded with freshly dug mandioc roots. Bread made from these tubers is the staff of life for the people of the Amazon

from sugar-cane juice, that can be diluted, so the story runs, if alcohol is added.

I was always invited to these celebrations, and upon my arrival invariably found a place of honor awaiting me—a new hammock usually, that had been stretched across a corner of the dance room. Then I learned another side to the vagabondage of these people. I remember one event especially. It was late in the afternoon and my Caboclo friends were busily cutting up and smoking chunks of peccary meat. Twenty-seven of these animals had been knocked over the head while swimming across the river earlier in the day, and, tied together like a raft, they had been towed ashore, much to the joy of everyone. Just as we were carving the last one, a long canoe appeared on the river and came crawling over the water on seven spidery legs as the paddlers splashed spray and thumped time against the sides. One of the men came up on the shore, while the others bathed in the river. "There is to be a *grande festa* at Sr. da Silva's, and he wants the *Senhor Americano*. He has sent us to bring him; will the *Senhor* please to come?" Yes, certainly the *Senhor* would, I responded with a smile, and went to my bag to get arrayed in my best. Over my worn-out breeches I pulled a pair of high boots which, sad to say, had been vigorously sampled on some previous night by an army of hungry saüba ants, the onslaughts of which had given each of the boots a sort of fringed appearance. A tight Norfolk hid my often patched but still torn shirt. I brushed my hair with my hands and parted it with my fingers, slipped on a stringy tie and put on my Stetson, the only article which was none the worse for wear, dirt, saübas, or rain. Then I was dressed.

I saw that each of the natives, besides having a paddle, had brought a musical instrument of some kind. There were three guitars, three smaller instru-

ments like ukuleles, which they called *guavaquinos* and a worn-out remnant of a harmonica. The paddlers told me that the stringed instruments, save one guitar, had been fashioned by hand from rough blocks of unseasoned wood, with waxed strands of tucum palm for strings.

As we floated in the calm of the after- twilight the men began playing and singing. It was delightfully languid, drifting so upon the starlit stream. Other craft, with music and singing of their own and with little lamps burning in their bows, became visible on the dark waters. There was much of Venice in the atmosphere, and we floated happily along until we were greeted by a loud explosion on shore and turned in with yells and catcalls. They had set off a wad of gunpowder to welcome us. There were many visitors arriving. The women trudged silently to the large, thatched hut farther back in the fire-scorched clearing, while the men, who had been paddling, took baths in the river to refresh themselves, and dressed in their best clothes. They rubbed sweet-smelling vaseline into their hair and parted it sleekly. Then, in one awkward, uneasy group we went up to the place of celebration, where we were greeted by *Senhor da Silva*, a humorous little old man with grizzled hair and bow legs. He led me within the well-lighted room to a splendid hammock and graciously asked me if I would honor them by sitting there.

Like most parties it was a bit awkward and slow at first, but soon things began to liven up, and we all felt at ease. I sat like a congenial patron in my comfortable, swinging seat and watched all that went on. Coffee and wild pig broth was passed frequently to me, and *caxasa* to the other, more eager guests. Long, bark-wrapped, peculiar-smelling cigarettes, were smoked by all of us. When the rural music began, the men went to the women's side, grabbed partners by the hands, and led them into the middle of the room, then began gliding

over the smooth, clay floor with graceful movements.

There were all classes of society in that swaying mass of happy people; all classes, that is, of Rio Negro society. I watched a woman with blue calico waist and full, pink ruffled skirt, whose blue-black hair was pulled back from her brown forehead and rolled Japanese-fashion in two puffs at the sides of her head, as she swung barefooted round in the crowd, as haughty and as graceful as any bejeweled lady of society. The little dandy with tight-fitting coat hitched in at the waist, whose hair had been plastered close to his narrow head by perfumed wax, pranced around with quick steps, clicking the wooden heels of his *chinelas* together rakishly. Even at this gathering, all the participants of which were dwellers in the jungle, the "hayseed" was present; awkward and lanky, he managed to keep going, watching his feet all the time, his round shoulders and long arms giving him a very loose-fitting aspect beneath his oversized garments. A little girl with pigtail and stiff pink dress seemed very happy in spite of the fact that she had to step lively and glance guardedly, in order that she might keep her naked toes from beneath the heavy soles of her youthful partner's sandals.

I did not dance; I only sat like a wise, old, abstinent owl and watched. Between dances *caxasa* and other liquids except water were passed to the guests. With the flowing of beverages a change came over the people. Usually, I observed, the traits manifesting themselves were the opposite to whatever characteristics were normally theirs. If most of the time they were all smiles and gaiety, they became sober, boorish, and with still more drink, brutish; if, on the other hand, they were habitually dull and sad-looking, they became gay and jovial. A drink of reverses it surely was!

Festivities kept up until just before the cold dawn. Then one by one the guests thanked their host and departed in their little canoes. Strangely I felt

no need of sleep; I had been so well entertained. In the canoe with me the men gossiped with each other like little schoolboys returning from their first party, and, besides, seemed gleefully pleased at snug reminiscences of some dark-skinned maiden who, it seems, had danced with them all. I curled up in the bottom of the dilatory canoe trying to keep warm; the misty, early-morning chill that lay over the water was very penetrating. I had had a little glimpse into another side of their life, the fun and ease-loving side, which prompted them to move here and there in quest of *festas* and *caxasa*.

Three months had passed. Part of it had gone quickly, and part dreadfully slowly. Christmas and the New Year had come and gone, and at such times, if at all, one feels the ties that bind him to his native soil. There were many nights, I vividly remember, in which I found no sleep, but lay restlessly meditating while smoking many pungent cigarettes of black, native tobacco. Then, one evening after sunset, the awaited launch appeared. Senhor F— stepped out of it, and greeted me effusively, hugging me and patting my back.

When it came time to part with my Caboclo hosts, I held out my silver-handled hunting knife to the head of the house. "No!" he sharply exclaimed, "We want no pay for our *hospitalidade*. It is not sold. It has been a pleasure."

"But," I insisted, "such an insignificant gift as this is not *pay*—I mean you to accept it as a memento of an *Americano* who was very hungry."

They laughed happily. They were easily made to laugh, those river folk; little things made them happy and they would stop any work to listen to a good joke or to tell a mirthful story. Life as they knew it was very carefree. They passed my knife from one to another with shining eyes, and as I was getting into the tiny launch, the old man ceremoniously handed me a beautifully woven hammock of fine tucum, tasseled and

prettily designed with white and black patterns. It was a valuable gift, for in Manaus my friends told me that it was worth every bit of seventy-five dollars. I thanked them as I took each by the hand, down to the smallest baby, and patted the envious, flea-bitten dogs that crowded excitedly at the water's edge. I was overwhelmed with gratitude to those people who had been so very kind to me and whom, I realized, I should probably never see again. Then I waved them a last farewell, and we chugged rapidly away downstream until they became mere specks, and then entirely disappeared.

The Portuguese gentleman who so hospitably carried me many miles through rapids to his large and comfortable villa on the lower river, where he fed me like a king on especially killed oxen, pigs, and chickens, and then carried me to Sao Isabel and put me on the little stern-wheeled steamer for Manaus, was only an elaboration of my previous hosts. He gave me more, simply because he had more to give. His industry had carried him away from their class, and he had no sympathy for people who, as he expressed it, came from nowhere and went nowhere, leaving nothing but rickety, thatched huts behind them. In some ways he was right; but he was not cognizant of the other side. In being so thoroughly practical he had missed, as so many others have missed, the deeper understanding of life that comes through a touch of sentiment. One of the ideals of life is to accomplish things, to amount to something; the other is to be contented while we live. We cannot always have both. These Rio Negro folk have few desires, and not being ambitious for worldly attainments, they live contentedly, experiencing none of the heartaches

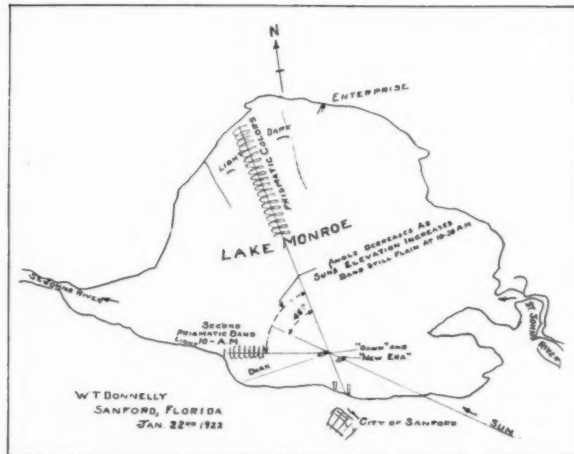
which come so often to those with larger aims. They are dwellers in a land where great physical efforts are unnecessary. A few holes punched in the ground, and shoots of mandioca bushes inserted, will soon yield large, tuber-like roots which may be ground and cooked into hard, life-giving bread. Fish are in the waters and game in the woods, and the palm trees provide excellent thatch for shelters.



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Future Amazon

If these people work a few months each year, they can buy, with the rubber they have collected and smoked from the wild rubber trees, cloth for clothing, some tobacco, ammunition, and more *caxasa* than is good for them. The thought that came to me so often was not how lazy they seemed, but how happy and contented they were with life as it was allotted to them.



AN OPTICAL PHENOMENON ON A FLORIDA LAKE

BY
WILLIAM T. DONNELLY

NOTE.—The article that follows represents the contents of a letter written by Mr. Donnelly under date of January 22, 1922. In a later letter he states that on two subsequent occasions he saw the phenomenon repeated.

MY YACHTS, "Dawn" and "New Era," are anchored in Lake Monroe, Florida, off the city of Sanford at the head of navigation on the St. Johns River. Lake Monroe is approximately $4\frac{1}{2}$ miles long by $3\frac{1}{2}$ miles wide; the St. Johns River enters at one end and leaves from the other. This morning when I came out on deck soon after sunrise, I noticed toward the east a remarkable phenomenon on the water. A band of prismatic colors, familiarly known as the rainbow, seemed to extend on the water, commencing about one third of the way across the lake and reaching to the shore. The atmosphere, while hazy, was in no sense foggy, and the sun was shining brightly. This phenomenon persisted and at the present time, 9.30 A.M., is truly remarkable. The haze has almost entirely disappeared. The lake is perfectly calm. The band of refracted light seems to be much broader than the usual rainbow phenomenon.

It occurred to me to measure roughly and record the angular relation of the prismatic band with the sun, and the most ready way of doing so was to take two triangles, sighting along one pointing to the prismatic path on the water and laying the other triangle across it. The result was so geometric as to be almost startling. It will be noted from the sketch that the angle formed by the projection of the sun's rays as compared with the path of the refracted light is

an angle of 45 degrees. It was perfectly simple to adjust these angles by sighting down the long side of the 45 degree angle and holding up a finger and adjusting the 60 degree angle until the shadow ran along its edge.

To me the remarkable fact about the phenomenon is its persistency and the brilliance of the refraction all the way across the prismatic scale; an added phenomenon is a very pronouncedly dark band to the right, or orange end, of the spectrum, and a bright band on the left, or purple end.

About breakfast time a young native paddled by in his canoe. When I asked him what he knew about the phenomenon, he replied that the rainbow was present every morning when the lake was calm. . . .

Since writing the above, the other end of the rainbow has appeared, relatively as noted on the sketch. It is even more brilliant than the first—in fact, the most brilliant prismatic scale and the most extended that I have ever seen. It is now past ten o'clock; almost every particle of haze has disappeared from the lake, but still the prismatic band persists. At this writing, the tender of the "Dawn," rowed by my daughter, is sailing down this band. Surely it is a land where one can chase the rainbow and, it would almost seem, with some prospect of capturing it, so close and friendly it appears to be.

NOTES

THE ENDOWMENT FUND OF THE AMERICAN MUSEUM

THE GIFT OF MR. GEORGE F. BAKER.—Since the last issue of *NATURAL HISTORY* went to press several gifts of unusual magnitude have been made by public-spirited citizens to the Endowment Fund of the American Museum. It is the hope of the Trustees that during the present year at least \$2,000,000 may be raised for this fund—an amount which is sorely needed if the Museum is to maintain the practical service which it is rendering to science and to education. The munificent sums donated thus far will encourage the Trustees in their unremitting efforts to see this hope fulfilled.

The initial subscription to the fund was made by Mr. George F. Baker, ever a loyal friend of the Museum, who contributed the sum of \$250,000, the income from which is to be used as the Board of Trustees may determine. At a meeting of the executive committee of the Board, held on June 21, 1922, the following resolution was passed:

"BE IT RESOLVED, That the Trustees desire to record their deep sense of gratitude to Mr. Baker for his generous gift of \$250,000, which constitutes the initial contribution to the much needed enlarged Endowment for the growth and development of the Museum. The Trustees deeply appreciate not only the intrinsic value of the gift, but especially the generous attitude of the donor in permitting the unrestricted use of the income of this fund—an action which is indicative of his confidence in the administration of the Museum and the aims and purposes of the institution. In recognition of Mr. Baker's earlier contributions, the Trustees have previously elected him a Benefactor and can therefore merely express their gratitude to him by extending their heartfelt thanks and best wishes for continued good health and happiness."

THE GIFT OF MR. JOHN D. ROCKEFELLER, JR.—On June 17 Mr. John D. Rockefeller, Jr. presented the American Museum with securities valued in excess of \$1,000,000. In a letter of President Henry Fairfield Osborn, announcing this generous gift, Mr. Rockefeller stated that he had long felt that the American Museum was playing an important part educationally and otherwise in the life of New York City—an impression that had been confirmed by a careful study of the Museum which he had recently caused to be made. Mr. Rockefeller expressed the hope that the sum of \$1,000,000 might be set aside for permanent endowment, the income therefrom to be applied to the current needs of the Museum. He added, however, that he realized the un wisdom of seeking to forecast the requirements of the distant future, and that he

was fully conscious of the dangers attendant upon the establishment of any endowment fund in perpetuity. Accordingly it would be agreeable to him, if at any time the Trustees deemed such a disposition to be in the best interests of the Museum, to have the whole or any portion of the principal of the gift devoted to any of the corporate purposes of the Museum.

In acknowledgment of Mr. Rockefeller's contribution, the Trustees passed the following resolution:

"RESOLVED, That the Trustees accept with grateful thanks the splendid gift of \$1,000,000 presented to the Museum by Mr. John D. Rockefeller, Jr. for its corporate purposes and hereby take pleasure in applying it to the Permanent Endowment Fund, the principal to be kept invested and the income only to be expended for the work of the institution.

"This munificent gift, valued at more than a million dollars, is the more appreciated because it is received at a time when the increase of the Permanent Endowment by at least \$2,000,000 stands as the paramount need of the Museum, in order that its scientific exploration and research may not be curtailed and in order that it may continue to render to public education, especially through the school system of the City and Country, a service which is increasing in importance and is receiving the universal approval of educators.

"Mr. Rockefeller's attitude in his generous terms of gift and in his liberal-mindedness with respect to the use of this fund is a further source of deep satisfaction and encouragement to the Trustees because it indicates his hearty endorsement of the aims and purposes of the Museum and of the Trustees' policy in its development and expresses his belief in the present and future service which it can render to science and education for all the people.

"In recognition of Mr. Rockefeller's interest in the Museum, the Trustees take pleasure in hereby electing him a *Benefactor*."

THE AMOS F. ENO BEQUEST.—The Museum also receives, under the terms of settlement of the contested will of the late Amos F. Eno, the sum of \$272,000, of which \$250,000 is to be added to the Endowment Fund.

ALBERT I, PRINCE OF MONACO

ALBERT I, Prince of Monaco, who died in Paris on June 27, at the age of seventy-four, was known the world over for his studies in oceanography, to which he devoted most of his spare time and much of his fortune. In yachts especially constructed for marine research, including successively the "*Hirondelle*," the first "*Princesse Alice*," and the second "*Princesse Alice*," he investigated the life of the seas and studied the ocean currents over an area extend-

ing from the tropics to the Arctic. He developed many new appliances for deep-sea dredging, and devised an electric lamp which when lowered to the black, sunless depths of the ocean, served as a bait to attract the fishes that live far below the surface. He added greatly to our knowledge of the distribution of the fauna of the seas, in addition to discovering many species new to science. The results of his researches were made known to the world not only through detailed publication but through the oceanographical museums which he established at Monaco and Paris.

With all his keen interest in marine research, he was also the liberal patron of other branches of science. In 1910 he wrote to the Minister of Public Instruction in Paris that in the course of his active life he had often regretted that a larger place had not been assigned in the intellectual movement of the day to studies tending to clear up the mystery enveloping the origins of humanity. To the end that such studies might receive more attention, he proposed the founding of the Institut de Paléontologie humaine, an institution which, generously endowed by the Prince, has become one of the leading agencies in contributing to our knowledge of early man.

It is only a little more than a year ago since the Prince of Monaco visited this country, where he lectured before various scientific bodies and was the recipient of many honors. On a previous visit the Prince had lectured before the American Museum and had made a tour of that institution, examining its exhibits with interest and expressing his cordial approval of the proposal to add to the Museum a hall of oceanic life, a project recently made possible through the generous action taken by the Board of Estimate and Apportionment in authorizing sums for the erection of a Southeast Court, which is to be given over exclusively to exhibits of marine life.

THE THIRD ASIATIC EXPEDITION

PROGRESS OF THE EXPEDITION TO MONGOLIA.—In a letter written from Urga Mr. Roy Chapman Andrews, leader of the Third Asiatic Expedition, which the American Museum is conducting in coöperation with the American Asiatic Society and with *Asia*, informs President Henry Fairfield Osborn that the expedition left Kalgan on April 21. For about 250 miles the automobiles were run rapidly, but the rate of progress did not prevent the geologists in the party from making scientific notations regarding the region covered. Half way across Mongolia, between Kalgan and Urga, interesting exposures were observed, and here the party camped. Mr. Walter Granger, the paleontologist of the expedition, and the geologists found fossils immediately and so promising did the locality

seem that Mr. Granger, Professor Charles F. Berkey, and Mr. Morris remained to explore the site more thoroughly when the rest of the party under Mr. Andrews pushed on to Turin, 152 miles south of Urga, where they hoped to find their caravan. Incidentally it may be said that this fossil locality proved to be of unusual importance, containing specimens of Cretaceous, Eocene, and Miocene age.

"We reached Turin without accident," writes Mr. Andrews, "and as we ran up the road, saw a great caravan and camped a few yards away. Then I suddenly saw the American flag and realized that it was our caravan. They had arrived just an hour before us, having been five weeks on the way from Kalgan. Pretty fine connections for a 700 mile journey across the plains, was it not? We went over to the great rocky outcrop and pitched our tents. The caravan arrived an hour later. It was an inspiring sight as the 74 camels wound up from the plain, with the American flag at the head. It made me realize, as nothing else has, that the expedition was really an accomplished fact, that all the nerve-racking work had resulted in this. It was a dream come true. Shackelford recorded it all in motion pictures from the moment the camels came into the rocky pass, until they lined up in three long rows and kneeled to have their loads removed."

That the party of explorers is by this time thoroughly seasoned may be gleaned from a paragraph in a recent letter of Professor Berkey:

"Desert life is strenuous but we are all standing it. We have already learned to wash only as often as the natives do and on the whole we do not look much unlike them. We have learned to eat sand with more or less relish in all kinds of food and to sleep peacefully with the chill winds simply sweeping through the tent and threatening to blow the flimsy-looking, ballooning thing into the Sea of Japan. Judging from the amount of wind that has come this way in the last week, there ought to be a great scarcity of atmosphere somewhere."

AMPHIBIANS AND REPTILES

THE HEILPRIN EXPEDITION TO SANTO DOMINGO.—In the projected Southeast Wing of the American Museum the third floor will be reserved as a hall of recent reptiles, animals the many-sided interest of which cannot be adequately indicated in the limited space at present available in the Museum. To secure two groups of unusual character for this new hall is the major purpose of the Heilprin Expedition, which under the leadership of Dr. G. Kingsley Noble and Mrs. Noble, of the American Museum, sailed on July 26 by the S. S. "Iroquois" for a sojourn of three months in the Dominican Republic. Although the West Indian region as a whole is rich in reptilian and amphibian life,

it is in Santo Domingo, and nowhere else, that are found two of the most spectacular creatures of the archipelago. These are the rhinoceros iguana, *Cyclura cornuta*, and the giant tree frog, *Hyla vasta*.

The former is a formidable-looking lizard that attains a length of as much as four feet and has on its snout a horn about one inch in height. It is extremely muscular, with big head and heavy jaws. It stands with its legs bent, bull-dog fashion, and when cornered, will face its pursuer, open its large mouth, and dart out its red tongue with blue-black tip, presenting an aggressive, even a terror-inspiring appearance. In its ways of life—in so far as these are known—it is not less interesting. In contrast to the true Central American and South American iguanas, which are semi-arboreal, semi-aquatic, taking to the water readily when disturbed, the rhinoceros iguana is terrestrial. Its habitat today is chiefly in the arid southwestern portion of Santo Domingo, in the vicinity of a dead sea, the surface of which is more than a hundred feet below sea level. There it lives in burrows, which presumably it digs itself.

Although our knowledge of the rhinoceros iguana is incomplete, much less is known about the other creature of the search, the *Hyla vasta*, the largest and most spectacular tree frog in the world. Only three specimens of this batrachian have been taken thus far. The locality of the type specimen has not been recorded. The other two specimens were found by the veteran naturalist, Dr. W. L. Abbott—one in the Central Cordillera, the other on the Quita Espuela, a range of mountains in the north-eastern part of Santo Domingo. The expedition, which will make an intensive search in the latter region, hopes to secure valuable scientific data bearing upon this frog, in addition to exhibition material. Dogs will probably be used in tracking and cornering the iguana, and full photographic equipment is being taken on the trip for the purpose of recording the behavior of the living animals. A supply of snake bags provided for the expedition suggests another activity incidental to the two main purposes.

REPTILES AND AMPHIBIANS COLLECTED BY THE THIRD ASIATIC EXPEDITION.—A shipment has been received at the American Museum consisting of reptiles and amphibians collected by the Third Asiatic Expedition, which the American Museum is conducting in coöperation with the American Asiatic Society and *Asia*. This shipment, the specimens of which are in unusually good condition—the colors of life, even the delicate pinks, being remarkably well preserved—includes 576 frogs and toads, 46 turtles, 170 lizards, 6 salamanders, and 181 snakes. The snakes will immediately engage the attention of Mr. Arthur Ortenburger, who

has accepted the position of assistant curator in the department of herpetology vacated by Mr. Karl Schmidt, who has left the Museum to take charge of the reptile department at the Field Museum, Chicago. Mr. Ortenburger, fellow in zoölogy during the past two years at the University of Michigan, and prior to that teaching assistant in that institution, is an authority on the genus *Coluber*, a genus that includes the true black snakes and the racers, and the results of his examination of the Chinese snakes, which show some affinities to those of eastern North America, will be awaited with interest.

MAMMALS

TO THE MEMORY OF JOEL ASAPH ALLEN.—The brief reference to a man's life inscribed on his gravestone is but one of many entries in a community of the dead. It is read by those who, with a feeling of detachment from the world, visit the resting place of those who have gone beyond recall from their several spheres of activity. Rarely does it fall to the lot of a man to have his memory associated for all time in an ineradicable manner with the interests that engaged his energies. Yet those who visit the North American mammal hall, now rechristened Allen Hall, and view the tablet of bronze with its fine portrait of the late Dr. Joel Asaph Allen, will always be reminded that the department of mammalogy of the American Museum owed its development to him, having for more than thirty-five years benefited by his devoted labors. In dedicating the hall to Dr. Allen's memory, President Henry Fairfield Osborn and the Trustees of the Museum performed a deed for which the scientific staff feel deeply grateful, and at a recent meeting of the division of zoölogy a motion was made and passed that the thanks of the division be conveyed to the President and the Trustees for their recognition in this signal manner of Dr. Allen's services.

A TRIP TO BRITISH GUIANA.—Herbert Lang, assistant curator of African mammals, will leave in September for British Guiana, returning to the American Museum toward the beginning of December. At Georgetown he will join Mr. William LaVarre, whose article on the Caboclos appears in this issue. Proceeding with him up the Essequibo River and continuing through the diamond mining district along the Mazaroni, Mr. Lang hopes to go beyond the forest to the savannah country and Mt. Roraima. This trip will afford an excellent opportunity for a comparative study of ecological conditions in the South American forests and savannahs with those in equatorial Africa. Such a first-hand comparison has been a long-felt want in connection with the preparation of certain reports on the American Museum Congo Expedition, of



Photograph by Joseph Brown & Son of Milwaukee

At the Zoological Garden in Milwaukee a moat-surrounded "monkey mountain" has been constructed, with trees for the animals to climb, a beach on which they may disport themselves, and a cave that offers a shelter from the winds. The "mountain" is an attraction not only for the monkeys but for a host of spectators.

which Mr. Lang was the leader. Photographic work will be one of the chief features. A visit is also contemplated to Director William Beebe, of the New York Zoological Society's Tropical Research Station at Kartabo. The zoological collections that Mr. Lang will make are to be presented to the American Museum.

A "MONKEY MOUNTAIN."—The Zoological Garden in Milwaukee, Wisconsin, possesses a unique feature in its "monkey mountain," located on an island. Mr. Edward H. Bean, the director of the garden, believes it to be different from anything that has been attempted in America. He has given an interesting description of it in the journal, *Parks and Recreation*.

The Park Commissioners of Milwaukee, realizing that monkeys entertain and hold the attention of visitors to the Zoological Garden longer than any other exhibit, erected an oval-shaped mound, suggestive of a mountain, 127 feet long and 82 feet wide, where the monkeys may be viewed under as nearly natural conditions as possible. On the south side of the mound a concrete cave was constructed, 7 x 9 x 7 feet, with an alcove facing south. This gives a large open space, protected from the north, west, and east winds in the early spring and late fall. At one end of the mound are a series of rock shelves about 4 feet wide, upon which the monkeys dis-

port themselves and where they also receive their food.

From the highest point on the mound a rivulet flows, winding its way westward over rocky precipices to a moat below. Where it terminates is a fairly extensive sand beach, on which the monkeys can bask in the sun. The entire surface of the mound, with the exception of the sand beach, is sodded. Norway maple, Austrian, Mugo, and white pine, and arbor vitae trees were planted as well as some memorial roses. The moat surrounding the mound is 30 feet wide; on its outer side a wall has been so constructed as to prevent the escape of the monkeys should any attempt to swim across the moat.

The species of monkeys given their liberty on this delightful island are golden baboon, hamadryas baboon, rhesus, common macaque, Japanese red-faced and pig-tailed monkeys. These get on well together and are very active and amusing to visitors. The place is so arranged that it is possible for four thousand visitors to enjoy the interesting antics of the monkeys under natural surroundings.

THE ISLAND OF MALTA

GROOVES of travel, traversed year after year by successive groups of tourists, tend to wear deeper and deeper, forcing the annual stream of

sight-seers to follow the established channels. Yet not far beyond the much-visited places—sometimes, in fact, ridiculously close to them—are spots that in spite of the interest they offer are comparatively neglected. Such a spot is the island of Malta, which, although only eighty miles south of Sicily, has been excluded from itineraries that have embraced Mediterranean ports of less appeal.

Great is the historic interest of Malta, which was successively occupied by the Phœnicians, the Romans, and the Moors, and which in the sixteenth century under the Knights of Malta was the doughty defender of the faith against the Turk. A still earlier phase of its history than any of those just mentioned is that represented by its Neolithic monuments, and readers of *NATURAL HISTORY* who have had their interest in early European man stimulated through the series of articles contributed to recent issues of the magazine by Professor Henry Fairfield Osborn may to advantage include Malta and the adjoining island of Gozo among the places to be studied. There are several megalithic buildings of the Neolithic period in Malta and Gozo and numerous minor evidences of the occupation of these islands by prehistoric man. Polished stone pendants, figures of stone and of earthenware, objects of flint, of native limestone, of bone, of clay, and of shell, votive axes, hammers, mortars, and other implements, vases of different wares and forms, are among the treasures that have been recovered from these ancient sites, and many of them may be viewed at the Valletta Museum, the curator of which, Dr. T. Zammit, has through his publications, written both singly and in collaboration with others, thrown interesting light on the archaeology of Malta.

Lest it be inferred that the attractions of Malta are limited to those stressed in the previous paragraph, mention should be made that in a recently issued booklet on the *Ichthyology of Malta*, Mr. G. Despott alludes to the fact that no less than 272 fishes are found in the waters surrounding the islands.

It is the earnest hope of the Honorable Mason Mitchell, the American Consul at Malta, whose keen interest in science is evidenced in part by his valuable gifts of specimens to the American Museum, that his fellow citizens in the United States may become cognizant of the attractions of Malta and may thereby be induced to view with their own eyes its excavated sites, the picturesque beauty of its palaces, its bastions and fortifications, and the quaint dress and customs of its natives.

EUROPEAN ARCHEOLOGY

FOSSIL MAN IN SPAIN.—Le Comte de Bégouen has recently issued a biographical sketch and



A section of the "monkey mountain," with a few of its denizens

appreciation of Émile Cartailhac, the great French archaeologist whose death was reported in a recent issue of *NATURAL HISTORY* (January-February, 1922, p. 93), in the course of which he records a striking instance of Cartailhac's devotion to the truth:

"Cartailhac was one of the first to concern himself with the prehistory of Spain. His beautiful and very rare work on the *Prehistoric Periods of Spain and Portugal* had opened the way to research of the peninsula. He had extended his explorations to include the subject matter presented in *Megalithic Monuments of the Balearic Isles*, and having for a long time been the prime mover in the study of prehistoric Spain, held a predominant position as an authority in this field.

"When M. de Santuola announced that he had discovered on the ceiling of a grotto in the environment of Santander certain prehistoric paintings, Cartailhac was skeptical and all the learned world ranged itself with him, casting doubt on the discovery of M. de Santuola. But as time progressed, one discovery succeeded another. Here and there were noticed on the walls of grottoes traces of black or red. The revision of a case too hastily judged was incumbent. Cartailhac left for Altamira; he saw and was convinced. He published immediately in

Anthropologic—the review which had succeeded *Matériaux*—under the title of "The *mea culpa* of an Anthropologist," an article in which he publicly confessed his error. Furthermore, with that ardor which was characteristic of him, he took up enthusiastically the study of these fine prehistoric paintings, from which study resulted, thanks to the generosity of the Prince of Monaco, that fine work on Altamira which is the initial volume in the splendidly illustrated series devoted to the decorated caves."

MAGIC, THE FIRST MOTIVE OF ART.—Another paragraph from the biographical sketch of Cartailhac will be of particular interest to those who, through the article contributed by Professor Henry Fairfield Osborn to the January-February issue of *NATURAL HISTORY* (pp. 27-41), have been made acquainted with the figure of the sorcerer found in the cavern of Les Trois Frères and the engraving of a similar figure discovered on a piece of schist rock in the grotto of Lourdes:

"The discoveries [of paintings] that followed one another in the grottoes of France and of Spain gave rise to the problem of the origin of this art. Taking his cue from what we know of the mentality of primitive peoples Cartailhac accepted the hypothesis of the magic origin of art. All the arrows carved or painted upon the animals represented were missiles of enchantment which on the eve of a hunt were mysteriously delineated in the most inaccessible and remote recesses of the grottoes in order to cast a spell upon the animal to be hunted. 'We are in the cave of the sorcerer,' he wrote from Marsoulas to M. Salomon Reinach and deep was his joy when he showed him under the bizarre masque the human face that is represented in the final chamber of the cavern of Les Trois Frères,—a divine spirit or a sorcerer dominating the numerous animals so skilfully represented beneath him.

"I have said that I would not analyze the scientific work of Cartailhac; I shall not speak therefore of his publications; I shall not enter into the details of his researches regarding certain points of chronology, especially regarding the Aurignacian period or the cut flints of the grottoes of Grimaldi. I shall not awaken the echo of certain scientific controversies that were at one time very intense. Time has softened them, in vindicating generally the keen and circumspect intellect of him who was my master and my friend."

PREHISTORIC SPANISH ART.—The exhibition of prehistoric Spanish art organized and carried to completion under the auspices of the Sociedad española de Amigos del Arte, claims attention as the first of its kind to be held anywhere in the world. It is fitting that an exhibition of this character should have had its inception in

Spain, a land which enshrines within its caves so many impressive examples of the art of Palæolithic man. The exhibition, an account of which appears in a handsomely illustrated pamphlet from the pen of D. Eduardo Hernández-Pacheco, consisted principally of copies of paintings and sculptures the originals of which are scattered throughout Spain, almost all of the localities of prehistoric interest being represented. Accompanying these copies were photographs of the sites, caverns, and rocks where the originals are located and photographs of the art objects themselves, besides diagrams of the caverns and maps showing the distribution of the prehistoric pictures in Spain. In glass cases were arranged utensils, arms, objects of ornament, and the like, illustrative of the degree of civilization attained by the people who made the paintings and serving also to indicate the period of their production.

THE ANTIQUITIES OF ROMAN BRITAIN.—We often need to be reminded that England was once a Roman province, traversed by magnificent Roman roads, protected by fortifications and walled camps. The tracing out of these ruins, the study of the many pottery, bronze, gold, silver, and even iron objects found in the ground and even in the beds of rivers enriches the archaeology of Britain. A rich collection of these materials is now housed in a special room of the British Museum under the keepership of O. M. Dalton and a handbook under the title, *A Guide to the Antiquities of Roman Britain in the Department of British and Mediæval Antiquities*, containing 13 plates and 142 illustrations, has just been issued describing these archaeological treasures.

LOWER INVERTEBRATES

DESTROYERS OF WHARF PROPERTY.—Great damage, amounting in the aggregate to several millions of dollars, has been wrought to the wharf property in San Francisco Harbor in recent years by the "shipworm," a marine mollusk, the soft body of which becomes long and wormlike when adult, while the shell remains quite small and is transformed into a burrowing apparatus. The shell is double and, in the young, is somewhat like that of a small clam, but in the adult it is furnished with rows of teeth, by means of which the animal drills into wooden structures, feeding upon the wood as it does so. Wharf piles, into which a number of these creatures have penetrated, become in time mere shells, honey-combed with burrows and, when they collapse, carry down with them the structures that have been reared upon them.

For some reason New York Harbor has been comparatively immune from the ravages of the "shipworm" although the animal has been

found in the Lower Bay as well as in Long Island Sound as far as its junction with the East River. The increased damage done in San Francisco Harbor within recent years occasioned the fear, however, lest similar injury might be inflicted upon the wharf property, valued at millions of dollars, along the New York water front. Accordingly, through the initiative of the National Research Council a committee was called into being early in 1922, consisting of forty-three engineers, chemists, and biologists, and including Dr. Roy W. Miner, curator of the department of lower invertebrates at the American Museum, and Dr. H. E. Crampton, until recently honorary curator of that department.

Although it is to be hoped that New Yorkers may be spared an extensive acquaintance with the living animal, they may familiarize themselves innocuously with its workmanship through a visit to the American Museum where, in an exhibit in course of completion, are shown wharf piles damaged by the shipworm and by *Limnoria*. The latter is a very small wood louse belonging to the group Crustacea, which also includes the shrimps and the crabs. *Limnoria* attacks the wood near the low water mark in large numbers and rapidly devours it. The burrows of the shipworm, on the other hand, seem to be most numerous on the part of the pile nearest the sea bottom.

DR. H. W. STUNKARD, RESEARCH ASSOCIATE.—Dr. Horace W. Stunkard, instructor in biology at New York University, was recently made research associate of parasitology in the department of lower invertebrates, American Museum. Dr. Stunkard is thoroughly experienced in the modern technique of this most difficult subject of research. He has already published several noteworthy papers on blood flukes and is engaged upon a monograph on the blood fluke parasites. This subject is very important from both an economic and a phylogenetic standpoint, as it tends to demonstrate that the evolution of these parasites has kept pace with the evolution of the higher vertebrates from lower types.

CAPTAIN FRANK POTTS.—A distinguished biologist from Cambridge University, England, Captain Frank Potts, visited the American Museum on his way to the Marine Laboratory of the Carnegie Institution at Tortugas, Florida, to complete investigations begun some years ago in collaboration with Dr. Alfred Mayor, the director of the Marine Laboratory, whose brilliant career was recently terminated prematurely by death.

INSECTS

THE LITTLE-CHANGING ANTS.—Dr. William Morton Wheeler, research associate of social

insects, American Museum, points out in the first of his Lowell Lectures, printed in the June issue of the *Scientific Monthly*, that "the ants have undergone no important structural modifications since the Lower Oligocene, that they had at that time developed all their various castes just as we see them today, that their larvæ and pupæ were the same, that they attended plant-lice, kept guest-beetles in their nests and had parasitic mites attached to their legs in the very same peculiar positions as in our living species, and that at least six of the seven existing sub-families and many of the existing genera were fully established." Dr. Wheeler is in a position to speak with full confidence because he had the opportunity some years ago of examining no less than 9,560 specimens, representing 92 species and 43 genera, from Lower Oligocene time. These insects had been trapped in the liquid resin that exuded from the pine trunks of that period and that later hardened. In this transparent medium, known as Baltic amber, insects are exquisitely preserved and offer exceptional opportunities for study.

AN ENTOMOLOGIST WINS LINNEAN SOCIETY MEDAL.—The gold medal of the Linnean Society of London, which is given alternately to a botanist and a zoölogist, was this year bestowed upon Professor E. B. Poulton, the well-known entomologist, at the anniversary meeting on May 24.

A VETERAN COLEOPTERIST HONORED.—Mr. Eugene A. Schwarz, honorary custodian of Coleoptera in the United States National Museum, was the recipient of the honorary degree of doctor of science at the commencement of the University of Maryland, on June 10.

LEAF-CUTTING BEES AND THEIR RELATIVES.—Through the kindness of Mr. William M. Savin we are able to publish a supplement to the article about the leaf-cutting bee and to the illustrations of its workmanship that appeared in the May-June issue of *NATURAL HISTORY*, pp. 250-57. The studies of this bee which Mr. Savin has been continuing this summer have yielded, like those of the previous year, interesting observations the value of which is enhanced by the superb photographic records which he has made. He writes of his work this summer as follows:

"New boards¹ containing nine burrows were put out to attract the bees and during the last few days of May the insects commenced to build their nests. One interesting feature of their work was that while there were old-fashioned single-rose bushes directly under the nests and

¹For a description of the general character of these boards the reader is referred to the May-June issue of *NATURAL HISTORY*, p. 258.



Photographed by William M. Savin

On the left *Megachile brevis*, builder of the lowest nest shown on the opposing page. On the right the *Osmia* that appropriated the shaft in which a *Megachile* had laid the foundation cell of her nest (see opposing page)

many of the leaves of these were fairly riddled by the removal of clippings, some of the bees went afield to secure cuttings. However, the *Megachile brevis*, the picture of which appears above, secured material for her nest from those bushes and frequently bees building elsewhere came to visit them for cuttings. Some *Megachile* were very rapid workers, snipping pieces in ten seconds, others worked very methodically and required twice as long.

"A bee of another genus was engaged in nest-building in one of the burrows. She was captured and found to be an *Osmia*. On uncovering the cells built by this *Osmia* it was discovered that she had preempted a *Megachile* nest after one cell had been completed by the leaf-cutter. The intruder's nest contained four cells, each one stocked with a pill of food consisting of nectar and pollen for the grub to feed upon when emerged. Partitions of dirt cemented with saliva divided the cells."

ALFRED GOLDSBOROUGH MAYOR

DR. ALFRED GOLDSBOROUGH MAYOR, director of the department of marine biology of the Carnegie Institution of Washington and a member of the American Museum, died in his laboratory at Tortugas on June 24 at the age of fifty-four years. In spite of the fact that he was weakened by a two years' fight against tuberculosis, he insisted upon opening the Tortugas laboratory for the season and was actively engaged in supervising the work there when the end came.

Doctor Mayor was a remarkable man in more than one line of scientific work. The son of the distinguished physicist, Prof. Alfred M. Mayor, he himself was brought up as a physicist and served as assistant in physics for a year each at Clark and Kansas universities. In keeping with this training, among his other accomplishments, he was an excellent navigator, and during the great war he taught navigation to hundreds of young men at Princeton University, writing for this course a short and simplified text which has been pronounced the best of its kind ever published.

After varied service as assistant to Alexander

Agassiz on the "Albatross" and in the Museum of Comparative Zoölogy, Doctor Mayor was curator-in-chief of the Brooklyn Museum, 1900-1904, and then went to the Carnegie Institution to spend the remainder of his life in its service.

As a zoölogist, Doctor Mayor was prominent in several lines of investigation. As a systematist, an evolutionist, and especially a physiologist his work will long endure. His largest contribution to science is his great three-volume work on the *Medusa of the World*, illustrated with his own paintings, for among his other accomplishments he was a zoölogical illustrator of distinction.

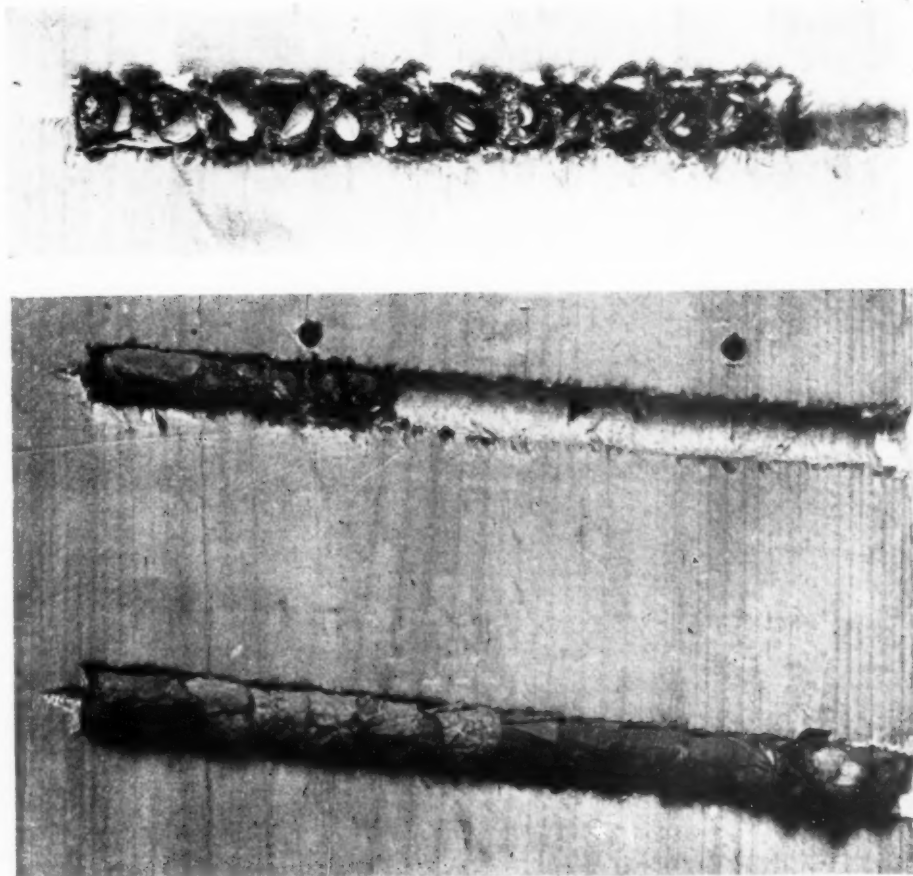
As the leader of scientific expeditions and director of marine laboratory work Doctor Mayor was without a peer; but those who have gone on these expeditions or have enjoyed the hospitality of the laboratory of the Carnegie Institution at Tortugas will always think of Doctor Mayor not only as a great zoölogist but also as a big-hearted, kindly, square-dealing gentleman.—E. W. GUDGER.

FISHES

THE MIAMI AQUARIUM AND LABORATORY.—During the winter and spring months (January to April, 1922) the Miami Aquarium and Laboratory, an account of which, written by Mr. John Treadwell Nichols, appeared in the issue of NATURAL HISTORY for July-August, 1921, pp. 356-66, was visited by upward of 70,000 people and its officers were in receipt of hearty words of praise and congratulation from the many who were impressed by the exhibition. During the summer and fall the Aquarium will be closed as it has been found through past experience that the attendance during that portion of the year is not sufficient to justify the heavy maintenance charges involved. The rare specimens have been placed, until the institution is reopened, in especially constructed "cars"—floating boxes to which the water penetrates freely—in Biscayne Bay, and are being watched over and fed by attendants detailed for that purpose. Less precious specimens have been made available to other aquariums. There will be no difficulty in replacing these specimens by others of the same or equally interesting species when the proper time arrives, for a careful survey has been made of the haunts of the many varieties of fish shown and to be shown, with the result that the collecting boats will be able in four weeks' time entirely to restock the tanks.

BIRDS

HAWAIIAN BIRDS.—In exchange for duplicate specimens of birds taken by the Whitney South Sea Expedition, the American Museum has received from the Bernice Pauahi Bishop



Photographed by William M. Saziri

The topmost nest, consisting of twelve cells stocked with food, is that of an *Osmia* bee. In each cell the mother has laid an egg. Eight of these eggs have already hatched and the larvae may be seen. The partitions between the cells are built of chewed pieces of leaf cemented with saliva. Some other *Osmia* mix a few scrapings of pith with this green paste; still others build their compartments solely of mud.

The middle nest is of interest because it shows that an *Osmia* preempted the shaft in which a leaf-cutting bee, *Megachile*, had begun to build. The long cylindrical cell is that of the leaf-cutter; the four shallow cells those of the *Osmia*.

A completed nest of *Megachile brevis* occupies the lowest shaft. A picture of this nest builder may be seen on the opposing page.

Museum of Honolulu a collection of birds from the Hawaiian Islands and from the islands to the west and south of this group that could not be duplicated from any other source. The collection, consisting of several hundred skins, comprises very nearly the complete avifauna of Hawaii. Among the specimens are not a few rare and extinct forms. Some of the birds are of historic interest because of the fact that their yellow and red plumage was used in the cloaks and helmets of the Hawaiian chiefs. Feathers of native birds were used also for the *leis*, or ruffs, worn about the head or the neck and in the hair, and for the ornamentation of the *kahilis*, or poles, that early in the history of the Hawaiians became symbols of rank, the larger ones being carried in the funeral processions of the great.

Among the birds that furnished feathers for one or another of these purposes were: the bright red iwi (*Vestiaria coccinea*), formerly the most abundant native bird but now like all the indigenous species much reduced in numbers; the oo (*Acrulocercus nobilis*), of brilliant black plumage with yellow tufts in sharp contrast, a bird found only on the island of Hawaii; the beautiful mamo (*Drepanis pacifica*), now nearly extinct if not actually so, the name of which has been applied to all royal war-cloaks.

AN HONOR CONFERRED UPON DR. R. C. MURPHY.—At the meeting on May 26 of the Sociedad Ornitológica del Plata in Buenos Aires, Dr. Robert Cushman Murphy, associate curator of marine birds, American Museum, was elected

a corresponding member. The distinction of honorary membership or of corresponding membership in this, the leading ornithological society of South America, has been conferred upon few individuals. Only one other American, Dr. Ridgway of the National Museum, shares with Dr. Frank M. Chapman the rank of honorary membership; Doctor Murphy is the fourth American to be made a corresponding member, Mr. George K. Cherrie being one of the other three upon whom has been bestowed this coveted distinction. The American Museum may well be proud that of the six Americans deemed worthy of inclusion in one or the other of these two groups, three have been selected from its scientific and field staff.

GEOLOGY

WESTERN TRIP OF DR. E. O. HOVEY.—Dr. Edmund Otis Hovey, curator of geology and invertebrate palaeontology, American Museum, has been making a tour of certain points of geologic interest, including Pikes Peak and vicinity, San Francisco, Crater Lake in Oregon, Mt. Rainier National Park in Washington, and Glacier and Emerald Lake (Burgess Pass) in British Columbia and Lake Louise and Banff in Alberta. One of the objects of his trip was to secure photographs and data for the relief models of Pikes Peak, San Francisco, and Crater Lake that are in course of construction in the department of geology.

SUMMER WORK OF DR. C. A. REEDS.—Dr. C. A. Reeds, associate curator of geology and invertebrate palaeontology, has been collecting data in New York and in New Jersey to be embodied in an exhibit illustrating "Climates Past and Present."

ANTHROPOLOGY

WILLIAM HALSE RIVERS.—We regret to announce the sudden death of William Halse Rivers of Cambridge, England, the distinguished English anthropologist. He was a leader not only in this field, but in psychology as well. Like William James, Doctor Rivers passed successively from neurology, through psychology, to anthropology. Then, during the late war, Doctor Rivers took up the problems involved in the treatment and cure of the nervous wrecks brought back from the battle lines. He made a great contribution to medical science by analyzing the type of disorder known as "shell shock" and by developing a method of treatment that resulted in a large percentage of cures. Doctor Rivers was born in 1874. During his life he was the recipient of many degrees from institutions of learning and of a gold medal from the Royal Society. In addition to his re-

searches in psychology and neurology, he studied native life in little-known parts of India and the South Seas. The untimely death of Doctor Rivers has deprived the world of one who was a real leader in several fields of scientific endeavor.

THE ANGRAND PRIZE FOR 1923.—The prize of 5000 francs established by Monsieur Angrand will be awarded in 1923 to the best work, whether published in France or elsewhere, during the years 1918-22, on the history, archaeology, or languages of the indigenous races of America prior to the arrival of Christopher Columbus. It is requested that contestants send ten copies of their works to the office of the secretary of the Bibliothèque Nationale before January 1, 1923. To works so sent the adjudicators may add others deemed worthy of inclusion. Early in January a list of works admitted to the competition will be sent to those of the adjudicators living outside of Paris, with the request that they designate before February 15, 1923, such additional works as appear to them worthy of being considered. Two copies of each work so designated should be placed at the disposition of the adjudicators.

The prize cannot be divided and a work must have the vote of ten of the eighteen adjudicators before an award can be made.

In 1918 the Angrand prize was bestowed upon Dr. Herbert J. Spinden, at that time assistant curator in the department of anthropology, American Museum, for his *Study of Maya Art*.

FOSSILS

THE FIRST MOUNTED SKELETON OF A DINOSAUR.—The *Hadrosaurus* skeleton in the museum of the Philadelphia Academy of Sciences was probably the first attempt to restore and mount the entire skeleton of a dinosaur. It was found in 1858, described by Doctor Leidy in 1859, and mounted by Waterhouse Hawkins some years later. The original bones were not used in the mount, but plaster casts were made of them, the missing parts modelled chiefly by analogy with modern reptiles, for very little was then known about dinosaurs. It is on the whole remarkably successful, considering the time when it was made. The skull was modeled from the modern tuatara lizard of New Zealand, as no dinosaur skulls were then known. This was a guess very wide of the mark, but the great variety of proportion and ornament in the skulls of various duckbill dinosaurs makes it still very doubtful what the skull of *Hadrosaurus* was like, as none have been found. It was thought at one time that *Hadrosaurus* was identical with the great western duckbill dinosaur *Trachodon*, but present evidence makes this improbable, although it was nearly related.

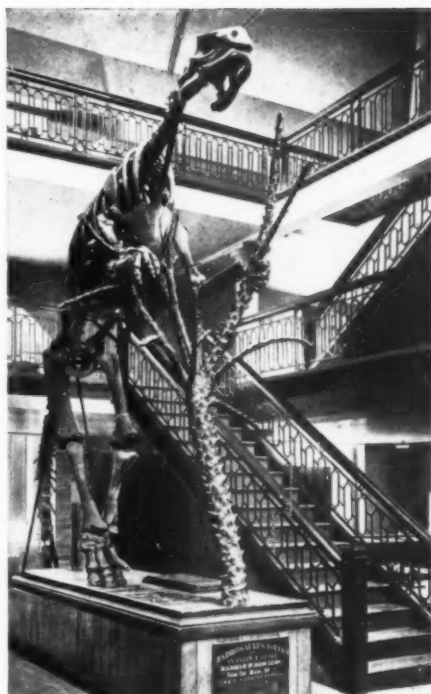
So far as the skeleton is concerned, the general proportions are quite correct, and the pose is not at all bad. The breastbone and the lower part of the pelvis are entirely wrong. But when one compares this mount with the restorations (models) of two European dinosaurs, *Megalosaurus* and *Iguanodon*, made by Waterhouse Hawkins in 1853 and still to be seen in the Crystal Palace at Sydenham, London, it shows a vast stride forward towards understanding the true form and proportions of dinosaurs. The short, squatty, toadlike proportions given to the Crystal Palace models are altogether unlike these dinosaurs, as we now know them to have been.

The discovery of the Age of Reptiles, like the discovery of America four centuries ago, was not all accomplished at one stroke. Rather it has been the result of a succession of explorations and researches into the records of the rocks. Step by step we have come to realize what dinosaurs were really like, their extraordinary proportions and immense variety of size and form and habits, and how large a part they played in the past history of the earth. The discovery of the *Hadrosaurus* may be considered as one of the great pioneer advances in revealing this world of ancient life.

GATHERINGS OF SCIENTIFIC SOCIETIES

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The summer session of the American Association for the Advancement of Science was held under the auspices of the Pacific Division of the Association from June 22 to June 24 at Salt Lake City. A research conference, at which Dr. John A. Widtsoe presented the topic, "Research Problems of the Great Basin," figured in the exercises of the first day. At the evening session the retiring president of the Pacific Division, Dr. Barton Warren Evermann, gave an address on "The Conservation and Proper Utilization of our Natural Resources." On June 23 a symposium of addresses was delivered on "The Problems of the Colorado River," followed in the evening by a banquet, at which Prof. James Harvey Robinson spoke on "The Humanizing of Knowledge." The concluding day was devoted to excursions and entertainments.

PALEONTOLOGISCHE GESELLSCHAFT.—A meeting of the *Paleontologische Gesellschaft* was held at Tübingen, Württemberg, August 9-12. An attractive program was provided, including, in addition to addresses and papers, visits to the collections in the Geologic-Paleontologic Institute and to sites of geologic interest. The gathering was under the presidency of Professor Othenio Abel, of the University of



The *Hadrosaurus* skeleton, representing what was probably the first attempt to restore and mount the entire skeleton of a dinosaur

Vienna, to whom was recently awarded the Daniel Giraud Elliot Medal. This medal is bestowed annually upon the author of such paper, essay, or other work on some branch of zoölogy or paleontology published during the year, as is in the opinion of the judges most meritorious and worthy of honor. It was Professor Abel's *Methoden der Paleobiologischen Forschung* (which President Henry Fairfield Osborn in presenting the medal referred to as an "inspiring work") that was deemed worthy of this coveted distinction. The medal, which carries with it an honorarium, has been previously awarded to Dr. F. M. Chapman, Mr. William Beebe, and Mr. Robert Ridgway.

FREE EMPLOYMENT BUREAU FOR ENGINEERS

The four national engineering societies, the offices of which are at 29 West 39 Street, New York City, maintain a free employment bureau that is in a position to furnish engineers, executives, and draftsmen to those requiring the services of qualified men in the different branches of engineering. The administration of the bureau is in charge of Mr. W. V. Brown, to whom applications should be addressed.

OTHER INSTITUTIONS

THE BUFFALO SOCIETY OF NATURAL SCIENCES.—Important services have been rendered to the community by the Buffalo Society of Natural Sciences, as indicated in the annual report of its president, which is printed in the July issue of *Hobbies*, the organ of the society. New exhibits have been installed in both the Old Museum and the New Museum. It is conservatively estimated that as many as 36,000 individuals visited the former building and no less than 39,000, the latter—a total of 75,000, during the twelve months. The work done among the school children deserves especial emphasis. During the year 284 lectures were delivered by Professor Pease to a total of 26,517 boys and girls. These lectures were closely correlated with exhibits in the museums and many of them were followed by arranged visits to the museums. A "children's story hour" on Saturday mornings, the "museum games," and the Roosevelt Field Club, which in the winter conducted a course of Sunday afternoon lectures on "How to Become a Young Naturalist" and in the spring and fall took its 270 members on hikes into the country, are other evidences of what the Buffalo Society of Natural Sciences is doing to stimulate the interest of the young in the world of nature. The society has a collection of upward of 35,000 lantern slides, arranged in more than 700 lecture sets, and these have been loaned widely for use in the home, before organizations, and in churches and schools. Last summer the society operated its first summer camp in the Allegany State Park, and although a guarantee fund was established to protect the society against loss, the camp was run so economically that it was possible to return to the guarantors the sum pledged.

NEWS FROM KARTABO.—In the work of the Tropical Research Station of the New York Zoölogical Society an incubator is proving of rare value, for by means of it Mr. William Beebe, the director of the Station, and his associates are able to study the anatomy and the habits of rare young birds. In a recent letter Mr. Beebe writes: "I have tried for years to get very young tinamou, and now by putting eggs in, I have a number of young birds, showing most interesting ostrich reactions and instincts. Having never seen nor heard one of their own kind, their behavior is a mental pure culture which can

hardly be misinterpreted." Yesterday I found claws on both the pollex and index fingers of the young tinamou as is the case in ostriches, rheas, and hoatzins."

THE MUSEUM OF THE CARNEGIE INSTITUTE.—The Carnegie Institute of Pittsburgh has issued a booklet containing the addresses delivered on its twenty-sixth annual celebration of Founder's Day, as well as tabular matter and other data bearing upon the Institute. Mr. Augustus K. Oliver, secretary of the Board of Trustees, in reporting upon the progress of the year, referred to the fact that the collections of the museum had grown greatly, both through explorations in distant fields and through the donations of friends. Advanced studies under the auspices of the curators of the museum are being pursued by numerous students of the University of Pittsburgh, and many hundreds of pupils from the schools have benefited as a result of conducted visits to the museum.

SINCE the last issue of *NATURAL HISTORY* the following persons have been elected members of the American Museum:

Patrons: DR. ERNEST G. STILLMAN and MR. EDWARD C. MOORE, JR.

Fellow: MR. GRAHAM SUMNER.

Life Members. MESSRS. THOMAS ANDREW FEUSS and D. E. POMEROY.

Sustaining Member: HENRY F. HERPERS

Annual Members: MRS. CHARLES H. FERRY; the MISSES FLORENCE V. BALL, MARY E. REED; SIR GEORGE MAY; THE HONORABLE W. E. HORNE, M. P.; DR. ADOLPH REICH; MESSRS. G. A. CABALLERO, ARTHUR A. CHALMERS, GEORGE H. CLARK, VERNON MUNROE, and FREDERICK J. ZIEGLER.

Associate Members: MESDAMES HELEN CHAPMAN, WILLIAM M. LEVEY, FRANCES E. MONSON, HANNAH WALLDEN, C. S. WILLIAMS, CHARLES ALBERT WOODRUFF; DR. GEORGE SANFORD FOSTER; MESSRS. FRED G. ANDERS, J. EDWARD CARLSON, T. B. KURATA, RUSSELL C. LEIBENGUTH, JOSEPH W. LEWANDOWSKI, FRANCIS B. RAY, KARL P. SCHMIDT, G. G. SCRANTON, M. VONSEN, and EASTERN LIGGETT SCHOOL.